# JEFFERSON MATH PROJECT REGENTS BY TYPE

## All 646 NY Math B Regents Exam Questions from June 2001 to June 2007 Sorted by Type

**(Answer Key)**

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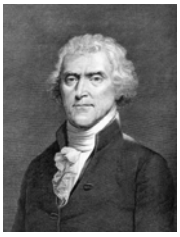

Dear Sir

I have to acknolege the reciept of your favor of May 14. in which you mention that you have finished the 6. first books of Euclid, plane trigonometry, surveying & algebra and ask whether I think a further pursuit of that branch of science would be useful to you. there are some propositions in the latter books of Euclid, & some of Archimedes, which are useful, & I have no doubt you have been made acquainted with them. trigonometry, so far as this, is most valuable to every man, there is scarcely a day in which he will not resort to it for some of the purposes of common life. the science of calculation also is indispensible as far as the extraction of the square & cube roots; Algebra as far as the quadratic equation & the use of logarithms are often of value in ordinary cases: but all beyond these is but a luxury; a delicious luxury indeed; but not to be indulged in by one who is to have a profession to follow for his subsistence. in this light I view the conic sections, curves of the higher orders, perhaps even spherical trigonometry, Algebraical operations beyond the 2d dimension, and fluxions.

Letter from Thomas Jefferson to William G. Munford, Monticello, June 18, 1799.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [1] | B | [29] | C | [57] | B | [85] | B | [113] | C | [141] | A |
| [2] | B | [30] | A | [58] | D | [86] | D | [114] | B | [142] | D |
| [3] | C | [31] | D | [59] | B | [87] | A | [115] | C | [143] | D |
| [4] | A | [32] | C | [60] | B | [88] | A | [116] | C | [144] | A |
| [5] | C | [33] | D | [61] | C | [89] | C | [117] | C | [145] | B |
| [6] | A | [34] | C | [62] | A | [90] | A | [118] | D | [146] | B |
| [7] | D | [35] | D | [63] | C | [91] | D | [119] | C | [147] | B |
| [8] | D | [36] | B | [64] | D | [92] | C | [120] | A | [148] | C |
| [9] | A | [37] | B | [65] | B | [93] | A | [121] | B | [149] | A |
| [10] | A | [38] | B | [66] | B | [94] | D | [122] | D | [150] | D |
| [11] | C | [39] | D | [67] | B | [95] | C | [123] | A | [151] | B |
| [12] | B | [40] | A | [68] | D | [96] | A | [124] | D | [152] | B |
| [13] | D | [41] | C | [69] | C | [97] | B | [125] | A | [153] | D |
| [14] | A | [42] | A | [70] | A | [98] | D | [126] | D | [154] | B |
| [15] | B | [43] | B | [71] | D | [99] | D | [127] | D | [155] | D |
| [16] | B | [44] | C | [72] | B | [100] | A | [128] | A | [156] | C |
| [17] | D | [45] | A | [73] | C | [101] | A | [129] | B | [157] | D |
| [18] | A | [46] | C | [74] | B | [102] | B | [130] | D | [158] | D |
| [19] | D | [47] | C | [75] | B | [103] | D | [131] | A | [159] | A |
| [20] | C | [48] | B | [76] | C | [104] | A | [132] | C | [160] | C |
| [21] | B | [49] | D | [77] | A | [105] | A | [133] | B | [161] | C |
| [22] | C | [50] | B | [78] | B | [106] | A | [134] | B | [162] | B |
| [23] | B | [51] | B | [79] | B | [107] | B | [135] | C | [163] | C |
| [24] | D | [52] | D | [80] | D | [108] | B | [136] | B | [164] | C |
| [25] | D | [53] | A | [81] | A | [109] | D | [137] | B | [165] | C |
| [26] | D | [54] | D | [82] | A | [110] | B | [138] | B | [166] | B |
| [27] | D | [55] | A | [83] | C | [111] | D | [139] | D | [167] | D |
| [28] | A | [56] | B | [84] | C | [112] | A | [140] | D | [168] | D |

| | | | | | |
|---|---|---|---|---|---|
| [169] A | [197] B | [225] A | [253] B | [281] A | [309] A |
| [170] A | [198] C | [226] A | [254] C | [282] D | [310] B |
| [171] B | [199] C | [227] B | [255] B | [283] A | [311] B |
| [172] D | [200] B | [228] B | [256] B | [284] B | [312] C |
| [173] D | [201] C | [229] C | [257] C | [285] C | [313] D |
| [174] B | [202] C | [230] D | [258] A | [286] B | [314] B |
| [175] B | [203] C | [231] C | [259] B | [287] C | [315] B |
| [176] B | [204] D | [232] A | [260] B | [288] C | [316] D |
| [177] B | [205] D | [233] D | [261] B | [289] C | [317] C |
| [178] D | [206] A | [234] A | [262] B | [290] D | [318] D |
| [179] B | [207] B | [235] B | [263] B | [291] B | [319] B |
| [180] B | [208] B | [236] D | [264] B | [292] D | [320] C |
| [181] B | [209] D | [237] B | [265] C | [293] A | [321] A |
| [182] C | [210] B | [238] D | [266] D | [294] D | [322] D |
| [183] A | [211] B | [239] A | [267] B | [295] A | [323] A |
| [184] C | [212] D | [240] D | [268] D | [296] A | [324] C |
| [185] A | [213] A | [241] B | [269] D | [297] D | [325] A |
| [186] D | [214] D | [242] D | [270] C | [298] B | [326] B |
| [187] B | [215] A | [243] A | [271] A | [299] B | [327] C |
| [188] B | [216] A | [244] D | [272] B | [300] B | [328] C |
| [189] B | [217] D | [245] B | [273] C | [301] B | [329] B |
| [190] C | [218] C | [246] C | [274] D | [302] C | [330] C |
| [191] A | [219] B | [247] B | [275] B | [303] D | [331] B |
| [192] D | [220] D | [248] C | [276] D | [304] C | [332] B |
| [193] A | [221] A | [249] D | [277] B | [305] A | [333] C |
| [194] A | [222] C | [250] B | [278] C | [306] D | [334] A |
| [195] C | [223] A | [251] D | [279] D | [307] D | [335] D |
| [196] A | [224] D | [252] B | [280] C | [308] C | [336] D |

[337] A

[338] A

[339] A

[340] D

[341] C

[342] A

[343] B

[344] D

[345] D

[346] A

[347] A

[348] C

[349] A

[350] C

[351] B

[352] C

[353] A

[354] C

[355] D

[356] C

[357] A

[358] B

[359] D

[360] A

[361] A

[362] C

[363] A

[364] B

[365] C

[366] C

[367] C

[368] C

[369] B

[370] B

[371] B

[372] C

[373] A

[374] C

[375] C

[376] C

[377] D

[378] D

[379] A

[380] A

[2] A correct indirect proof is written with appropriate statements and reasons.
[1] The assumption that $\overline{AT}$ is perpendicular to $\overline{CD}$ is written, but no further correct work is shown.
or [1] A method other than an indirect proof is used to show that $\overline{AT}$ is not perpendicular to $\overline{CD}$.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[1]

[2] 142.5, and appropriate work is shown, such as $\frac{1}{2}(16)(21)(\sin 58°)$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] An incorrect trigonometric function is used, but an appropriate answer is found, such as $\frac{1}{2}(16)(21)(\sin 58°)$, resulting in an answer of 89 or 89.0.
or [1] 142.5, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[2]

[2] 0.345, and appropriate work is shown, such as solving the equation $\theta = \frac{1.38}{4}$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 0.345, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[3]

[2] No, and appropriate work is shown, such as setting the expressions equal to each other, with one trials showing that the two expressions are not always equal.
[1] No, but only one trial shows that the two expressions are not always equal.
or [1] Yes, but appropriate work is shown, such as using 0° and 180° as trials.
[0] No or yes, and no work or incorrect work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[4]

[2] -3 + *i*, and an appropriate graph is drawn.
[1] The sum is found incorrectly, but an appropriate graph is drawn.
or [1] -3 + *i*, but no graph or an incorrect graph is drawn.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[5]

[2] $-4 \le C \le 36$, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but only one extreme value is found.
or [1] $-4 \le C \le 36$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[6]

[2] 105, and appropriate work is shown, such as $\frac{7\pi}{12} \cdot \frac{180}{\pi}$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 105, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[7]

[2] 1,584.89, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] 1,584.89, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[8]

[2] 70, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] The values for n = 1 through n = 5 are computed correctly, but they are not added.
or [1] 70, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[9]

[2] –7 + i, and appropriate work is shown, such as (–2 + i)(3 + i).
[1] Appropriate work is shown, but one computational error is made.
or [1] –7 + i, but no work is shown.
[0] (–2 + i)(3 + i) is shown but not multiplied, or the values are added instead of multiplied.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[10]

[2] 20, and appropriate work is shown, such as using the formula $S = r\theta$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 20, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[11]

[2] 20.1, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] The time when the ball reaches its maximum height is found correctly, but no further correct work is shown.
or [1] 20.1, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[12]

[2] 7, and appropriate work is shown, such as $23 = x + 1$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $23 = x + 1$ is written, but no further correct work is shown.
or [1] 7, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[13]

[2] 7,800, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] 7,800, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[14]

[2] 0.341 or 34.1% or an equivalent answer, and appropriate work is shown.
[1] 0.682 or 0.841 or some other probability related to one standard deviation from the mean is shown.
or [1] 0.341 or 34.1% or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[15]

[2] 1 and 2, $1 < x < 2$, or $1 < 1.854 < 2$, and appropriate work is shown.
[1] $\frac{3}{h} = \frac{h}{3-h}$ is shown, but one computational error is made.
or [1] The positive root, 1.854, is obtained from the quadratic, but the two correct consecutive integers are not stated.
or [1] 1 and 2, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[16]

[2] 4, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 4, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[17]

[2] 49.8, 65.1, and 65.1, and the appropriate use of the area formula is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Only one or two angles are found correctly.
or [1] Cosine is used instead of sine, but appropriate work is shown.
or [1] The setup is appropriate, but incorrect work is shown, such as the sine of the angle but not the angle is found.
or [1] 49.8, 65.1, and 65.1, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[18]

[2] Two, and appropriate work is shown or an appropriate diagram is drawn.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Appropriate work is shown, but only one correct solution is found.
or [1] Two, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[19]

[2] $18 - 4i$, and appropriate work is shown, such as $(8 + 8i) + (10 - 12i)$.
[1] Appropriate work is shown, but one computational or graphing error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] A graphic solution is drawn, but the sum is not expressed in $a + bi$ form.
or [1] $18 - 4i$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[20]

[2] 77.9, and appropriate work is shown, such as evaluating $\frac{1}{2}ab\sin C$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as writing $\cos C$.
or [1] 77.9, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[21] incorrect procedure.

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[2] 0.3 or an equivalent answer, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but no answer is found.
or [1] 0.3 or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[22] incorrect procedure.

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[2] $\frac{2x+3}{x(x+3)}$ or $\frac{2x+3}{x^2+3x}$, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made or the answer is not simplified completely.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $\frac{2x+3}{x(x+3)}$ or $\frac{2x+3}{x^2+3x}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[23] incorrect procedure.

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[2] $r=\sqrt[3]{\frac{3V}{4\pi}}$ or $r=(\frac{3V}{4\pi})^{\frac{1}{3}}$ or an equivalent answer, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $\sqrt[3]{\frac{3V}{4\pi}}$ or $(\frac{3V}{4\pi})^{\frac{1}{3}}$ or an equivalent answer is found, and appropriate work is shown, but an equation is not written.
or [1] $r=\sqrt[3]{\frac{3V}{4\pi}}$ or $r=(\frac{3V}{4\pi})^{\frac{1}{3}}$ or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[24] incorrect procedure.

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[2] 4(x – 2) or 4x – 8, and appropriate work is shown.
[1] The problem is factored correctly but not reduced to simplest form.
or [1] Only two of the expressions are factored correctly, but an appropriate answer is found.
or [1] 4(x – 2) or 4x – 8, but no work is shown.
[0] Only the formula for volume is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[25] obviously incorrect procedure.

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[2] 2.6, and appropriate work is shown, such as solving the equation $(10+x)^3 = 2000$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] The equation $(10+x)^3 = 2000$ is written, but no further correct work is shown.
or [1] An incorrect equation of equal difficulty is solved appropriately.
or [1] 2.6, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[26]

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[2] $\frac{x+4}{4}$, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $\frac{x+4}{4}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[27]

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[2] 56, and appropriate work is shown, such as $\frac{1}{2}\cdot 14\cdot 16\cdot \sin 30$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 56, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[28]

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[2] $\frac{\pi}{3}$, and appropriate work or an appropriate diagram is shown.
[1] Appropriate work is shown, but the answer is not expressed in simplest form.
or [1] A correct diagram is drawn, but no answer or an incorrect answer is found.
or [1] 60°, and appropriate work or an appropriate diagram is shown.
or [1] $\frac{\pi}{3}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[29]

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[2] $\frac{3}{2}$, and appropriate work is shown.
[1] Appropriate work is shown, but one conceptual error or one computational error is made.
or [1] $\frac{3}{2}$, but a graphic solution is provided.
or [1] $\frac{3}{2}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[30]

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[2] 2, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 2, but a method other than an algebraic solution is used.
or [1] 2, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[31]

[2] $20 < x < 100$, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or graphing error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Appropriate work is shown to solve for 20 and 100, but the solution is not expressed as a correct inequality or interval.
or [1] $20 < x < 100$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[32]

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[2] $\frac{5}{6}$ or $0.8\overline{3}$, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made, such as representing $\frac{5}{6}$ as a terminating decimal.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $\frac{5}{6}$ or $0.8\overline{3}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[33]

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[2] $k > \frac{1}{3}$, and appropriate work is shown, such as the solution of $4 - 4(3)(k) < 0$.
[1] Appropriate work is shown, but one conceptual error or one computational error is made.
or [1] Appropriate work is shown, but the answer is written as $k < \frac{1}{3}$.
or [1] $k > \frac{1}{3}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[34]

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[2] $-\frac{3}{5}$, and appropriate work is shown, such as $\cos(x + 180) = \cos x \cos 180° - \sin x \sin 180° = \frac{3}{5}(-1) - \frac{4}{5}(0)$.
or [2] $-\frac{3}{5}$, and appropriate work is shown, such as $\cos(x + 180) = -\cos x$.
or [2] $-\frac{3}{5}$, and angle x is found, and correct substitution leads to $\cos(x + 180)$.
[1] Appropriate work is shown, but one computational error is made.
or [1] $\cos x = \frac{4}{5}$ is found, but substitution errors are made.
or [1] $-\frac{3}{5}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[35]

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[2] 8, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[36]

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[2] 65,797.36, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] An incorrect derivation of the equation is solved appropriately.
or [1] 65,797.36, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[37]

[2] 6.9. and appropriate work is shown, such as $2.4 \cdot 165 \cdot \frac{\pi}{180}$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Appropriate work is shown, but the calculations are performed in radians.
or [1] Correct substitution is made into the equation for the length of the arc, but no further correct work is shown.
or [1] 6.9, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[38]

[2] $-40x^2y^3$, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $-40x^2y^3$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[39]

[2] 11, and appropriate work is shown, such as f(l) = 4 and g(4) = 11.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as solving for f(g(l)).
or [1] 11, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[40]

[2] A correct graph is drawn to represent $2 + 6i$.
[1] Appropriate work is shown, but one computational or graphing error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] The sum 2 + 6*i* is written, but no graph is drawn.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[41]

[2] 3, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] The expression 3 + 4*i* is found, but *c* is not identified.
or [1] 3, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[42]

[2] 18, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] The equation $\log_b \frac{36}{2} = \log_b x$ is written, but the value of *x* is not found.
or [1] 18, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[43]

[2] 95, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as calculating g(h(4)).
or [1] 95, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[44]

[2] An appropriate explanation is given, such as:
One very high or very low score in either class would have a great effect on the range for that class, but might not affect the median at all. The range is the difference between the two most extreme values, the lowest and the highest. The median, being the middle value, is not very sensitive to outliers or to extreme values.
or [2] Specific examples are shown to illustrate the situation.
[1] An understanding of median and range is demonstrated, but the specific situation is not explained.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[45]

[2] 8, and appropriate work is shown, such as 5(70) = 43.75x.
[1] 4, and \$87.50 is used instead of \$43.75 per person.
or [1] Appropriate work is shown, but one computational error is made.
or [1] 8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[46]

[2] A graph is sketched that maps (–3,5) to (–6,10), (0,1) to (0,2), and (1,3) to (2,6).
[1] One graphing or computational error is made, but an appropriate graph is sketched.
[0] A graph is sketched that represents a dilation of only x or y.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[47]

[2] $\frac{5\pi}{4}$ or an equivalent answer in radian measure, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 225 or 225°, but appropriate work is shown.
or [1] The measure of the angle in a counterclockwise rotation is found, resulting in an answer of $\frac{3\pi}{4}$.
or [1] $\frac{5\pi}{4}$ or an equivalent answer in radian measure, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[48]

[2] $1\frac{1}{4}$ or an equivalent answer, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $1\frac{1}{4}$ or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[49]

[2] 4, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] The second root of the equation is found, but the sum of the roots is not calculated or is calculated incorrectly.
or [1] 4, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[50]

[2] \$1.48, and appropriate work is shown, such as providing a correctly labeled table or solving the equation $(1.39)(1.005)^{12} = C$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as using 1.05 or 1.5 or using an incorrect exponent.
or [1] A correct equation is written, but no further correct work is shown.
or [1] An incorrect equation of equal difficulty is solved appropriately.
or [1] \$1.48, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[51]

[2] $\sqrt{171}$ or 13 or 13.1 or 13.08 or an equivalent answer, and appropriate work is shown, such as the use of the equation of a circle $(x^2 + y^2 = r^2)$ or the Pythagorean theorem.
[1] Appropriate work is shown, but one computational error is made.
or [1] Incorrect analysis is shown, such as $x$ = 5 and $y$ = 14, but the work is concluded appropriately.
or [1] A correct answer is found, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[52]

[2] –4 ± 3i, and appropriate work is shown.
[1] The quadratic formula is used correctly, but one computational error is made.
or [1] $\frac{-8 \pm 6i}{2}$, but appropriate work is shown.
or [1] –4 ± 3i, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[53]

[2] 6, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Appropriate work is shown, but the negative root is not rejected.
or [1] A correct equation is written, but no further correct work is shown.
or [1] An incorrect equation of equal difficulty is solved appropriately.
or [1] 6, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[54]

[2] 621.1, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] A correct formula is written, but incorrect substitutions are made.
or [1] An incorrect proportion is written, but an appropriate solution is found.
or [1] The correct circumference is found, but no further correct work is shown.
or [1] 621.1, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[55]

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[2] 65, and appropriate work is shown, such as $P(10) = 80(0.98)^{10}$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 65, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[56]

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[2] $-\frac{s}{r(r+s)}$ or $-\frac{s}{r^2+rs}$, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Appropriate work is shown, but the answer is not expressed in simplest form.
or [1] $-\frac{s}{r(r+s)}$ or $-\frac{s}{r^2+rs}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[57]

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[2] 6, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as evaluating $(g \circ f)(5)$, resulting in an answer of 24.78270016.
or [1] 6, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[58]

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[2] 6.9, and appropriate work is shown, such as using special right triangles, the Law of Cosines, or the Law of Sines.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 6.9, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[59]

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[2] 1.5 and a correct diagram is drawn, and appropriate work is shown.
[1] Appropriate work is shown and a correct answer is found, but an incorrect diagram is drawn.
or [1] A correct diagram is drawn, but no further correct work is shown.
or [1] An incorrect diagram is drawn, but an appropriate answer is found.
or [1] 1.5, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[60]

[2] $y = 1.08x - 2125$ or an equivalent equation is written.
[1] One conceptual error is made, such as writing a regression equation that is not linear.
or [1] The expression $1.08x - 2125$ is written, but no equation is written.
or [1] The correct values are identified for *a* and *b*, but no equation is written.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[61]

[2] 0.624 or 62.4%, and appropriate work is shown.
[1] The correct standard deviations of –1.5 and +0.5 are found, but an incorrect probability is calculated.
or [1] Appropriate work is shown, but one computational error is made.
or [1] 0.624 or 62.4%, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[62]

[2] 32, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Only the constant of variation, 28,800, is found.
or [1] 32, but no work is shown.
[0] Direct variation is used.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[63]

[2] 12, and appropriate work is shown, such as solving $2{,}500 = 4(2.7)^{0.584t}$.
[1] Appropriate work is shown, but the answer is not rounded or is rounded to 11.
or [1] Appropriate work is shown, but one computational error is made.
or [1] 12, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[64]

[2] Appropriate work is shown, such as (a + bi)(a – bi) = $a^2 + b^2$.
[1] The conjugate is incorrect, but multiplication and substitution for $i^2$ are appropriate.
or [1] The conjugate is correct, but one or more errors in multiplication and/or substitution for $i^2$ are made.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[65]

[2] 30, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] 30, but no work is shown.
[0] Direct variation is used to find a solution.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[66]

[2] 41,583, and appropriate work is shown.
[1] Appropriate work is shown, but one conceptual error or one computational error is made.
or [1] 41,583, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[67]

[2] 9.42, and appropriate work is shown, such as changing the angle to radians and finding s.
[1] The formula $s = \theta r$ is stated, but 54° is not converted to radian measure.
or [1] Appropriate work is shown, but one computational or rounding error is made.
or [1] 9.42, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[68]

[2] .3087 or an equivalent answer, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as evaluating ${}_5C_3(0.3)^3(0.7)^2$.
or [1] .3087 or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[69]

[2] 5, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 5, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[70]

[2] 8, and appropriate work is shown, such as $(PA)^2 = 4 \times 16 = 64$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as failing to reject the negative root.
or [1] 8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[71]

[2] 50, and appropriate work is shown, such as $2(1 + 3 + 5 + 7 + 9)$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but $(1 + 3 + 5 + 7 + 9)$ is not multiplied by 2, resulting in an answer of 25.
or [1] 50, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[72]

[2] No, and a correct justification is given.
[1] No, but an incomplete or partially incorrect explanation is given.
[0] No, but no explanation is given.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[73]

[2] 5,279.61, and appropriate work is shown, such as $3{,}500(1+\frac{0.0825}{12})^{(12\times5)}$.
[1] Appropriate work is shown, but one computational or substitution error is made.
or [1] 5,279.61, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[74]

[2] $\frac{4}{3}$ or $1\frac{1}{3}$ or $1.\overline{3}$, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $\frac{4}{3}$ or $1\frac{1}{3}$ or $1.\overline{3}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[75]

[2] 13.3, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] The correct value is substituted for n, and the equation is converted to exponential form, but it is not solved.
or [1] 13.3, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[76]

[2] 255, and appropriate work is shown, such as $g(3) = 3^2 - 1$ and $f(8) = 2^8 - 1 = 255$.
[1] Appropriate work is shown, but one computational error is made.
or [1] One conceptual error is made, such as evaluating $(g \circ f)(3)$.
or [1] 255, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[77]

[2] 300, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] 300, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[78]

[2] $\Delta HOC$ and opposite, and an appropriate explanation is written.
[1] The image of $\Delta EOA$ is identified incorrectly, but the type of isometry is appropriate, and an appropriate explanation is written.
or [1] The difference between a direct and opposite isometry is explained correctly, but no further correct work is shown.
or [1] $\Delta HOC$, but no explanation or an incorrect explanation is written.
[0] Opposite, but no further correct work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[79]

[2] $\frac{9}{64}$, and appropriate work is shown, such as ${}_3C_2(\frac{1}{4})^2(\frac{3}{4})^1$.
[1] Only ${}_3C_2(\frac{1}{4})^2(\frac{3}{4})^1$ is shown.
or [1] Appropriate work is shown, but one computational error is made.
or [1] $\frac{9}{64}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[80]

[2] 1,032, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 1,032, but no work is shown.
[0] Direct variation is used instead of inverse variation.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[81]

[2] $8.5+7i\sqrt{3}$, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $8.5+7i\sqrt{3}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[82]

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[2] A mapping is drawn that maps at least one element of set A to more than one element of set B, and an appropriate explanation of the difference between functions and relations is written.
[1] An appropriate mapping is drawn, but no explanation is written.
or [1] An incorrect mapping is drawn, but an appropriate explanation is written.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[83]

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[2] 1.4, and appropriate work is shown, such as finding the axis of symmetry.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] 1.4, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[84]

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[2] $\frac{60}{729}$ or $\frac{20}{243}$ or .0823, and appropriate work is shown, such as ${}_6C_2(\frac{2}{3})^2(\frac{1}{3})^4$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] A correct expression is written, such as ${}_6C_2(\frac{2}{3})^2(\frac{1}{3})^4$, but no further correct work is shown.
or [1] $\frac{60}{729}$ or $\frac{20}{243}$ or .0823, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[85]

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[2] (-5,-7), and appropriate work is shown, such as stating the coordinates of each transformation or graphing each transformation.
[1] Appropriate work is shown, but one computational or graphing error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as performing the translation before the reflection.
or [1] Only one of the transformations is performed correctly.
or [1] (-5,-7), but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[86]

[2] An explanation is given that indicates that a set of data can represent inverse variation if the product of two variables is constant, and a correct table of values is shown.
[1] The rule for direct rather than inverse variation is stated, but an appropriate equation and table of values are shown.
or [1] An example of inverse variation is shown, but no explanation of why it is an inverse variation is given.
or [1] An explanation is given that indicates that a set of data can represent inverse variation, but no table of values is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[87]

[2] 5, and appropriate work is shown, such as stating the mean and the standard deviation.
[1] Appropriate work is shown, but one computational error is made, but an appropriate number of scores is found.
or [1] Appropriate work is shown, but one conceptual error is made, such as using the sample standard deviation.
or [1] The mean and standard deviation are found correctly, but the number of scores is missing or is incorrect.
or [1] 5, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[88]

[2] Mean = 31 and standard deviation = 3.2, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Either the mean or the standard deviation is determined correctly, and appropriate work is shown.
or [1] Mean = 31 and standard deviation = 3.2, but no work is shown.
[0] Mean = 31 or standard deviation = 3.2, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[89]

[2] 8 or an equivalent answer, and appropriate work is shown.
[1] The denominators are cleared correctly, such as $6(t + 16) + 6t = t(t + 16)$, but the factoring is incorrect, or one error is made using the quadratic formula.
or [1] The denominators are not cleared correctly, but an equation of equal difficulty is solved.
or [1] 8 or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[90]

[2] 67, and appropriate work is shown, such as $A = \frac{1}{2}(11)(13)\sin 70°$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 67, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[91]

[2] 2 cos x, and appropriate work is shown, such as factoring the numerator and substituting $\cos^2 x$ for $1-\sin^2 x$.
[1] Appropriate work is shown, but one factoring or substitution error is made, or the expression is not simplified completely.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 2 cos x, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[92]

[2] 307, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Appropriate work is shown to find the value of the reference angle, but no further correct work is shown.
or [1] 307, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[93]

[2] 4, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 4, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[94]

[2] $-\frac{4}{5}$ or –0.8, and appropriate work is shown.
[1] $\frac{4}{5}$ or 0.8, and appropriate work is shown, but the quadrant was not taken into consideration.
or [1] $-\frac{4}{5}$ or –0.8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[95]

[2] 4.4, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Only the constant of variation, 220, is found.
or [1] 4.4, but no work is shown.
[0] Direct variation is used.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[96]

[2] More than 6 hours, and appropriate work is shown, using a graphic or algebraic solution.
[1] Appropriate work is shown, but one computational error or an error in analyzing the results is made.
or [1] More than 6 hours, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
[97]

[2] 1.15, and appropriate work is shown, such as $\frac{x}{\sin 130} = \frac{0.75}{\sin 30}$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as using an incorrect trigonometric function.
or [1] A correct trigonometric equation is written, but no further correct work is shown.
or [1] 1.15, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[98]

[2] A complete and correct explanation is written, such as stating that since the graph lies entirely above the x-axis, there is no point on the graph where y = 0.
[1] An incomplete or partially correct explanation is written, such as stating that the equation has imaginary roots.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[99]

[2] 3, and appropriate work is shown, such as $\frac{10}{\sin 53°} = \frac{b}{\sin 14°}$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] The proportion $\frac{10}{\sin 53°} = \frac{b}{\sin 14°}$ is written, but no further correct work is shown.
or [1] An incorrect proportion of equal difficulty is solved appropriately.
or [1] 3, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[100]

[2] An appropriate reflection of f(x) in the line y = x is sketched, and the coordinates of one point are stated correctly.
[1] An appropriate graph is sketched, but no coordinates or incorrect coordinates are stated.
or [1] A reflection in some other line is sketched, but appropriate coordinates are stated.
or [1] An incorrect graph is sketched, based on an error in plotting one of the points, but appropriate coordinates are stated.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[101]

[2] $\frac{-x-3}{10x+2}$ or an equivalent answer in simplest form, and appropriate work is shown.
[1] Either the numerator or the denominator is factored completely.
or [1] Appropriate work is shown, but $\frac{3-x}{x-3} = -1$ is not recognized.
or [1] $\frac{-x-3}{10x+2}$ or an equivalent answer in simplest form, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[102]

[2] 50, and appropriate work is shown, such as $m\overset{\frown}{AC}=140,\ m\overset{\frown}{BC}=40,$ and $m\angle CPA=\frac{1}{2}(140-40)$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $m\overset{\frown}{AC}$ and $m\overset{\frown}{BC}$ are found correctly, but no further correct work is shown.
or [1] 50, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[103]

[2] The Adams School, and an appropriate explanation is given, such as the standard deviation is a measure of dispersion, which is how much the scores, on the average, differ from the mean. Therefore, the school with the smaller standard deviation would have the more consistent scores.
[1] The Adams School, but an incomplete explanation is given, or the school is not stated, but an appropriate explanation is given.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[104]

[2] 30 and 150, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Appropriate work is shown, but only 30 or 150 is found.
or [1] 30 and 150, but no work is shown.
[0] 30 or 150, but no work is shown.
or [0] The value of $\sin\theta$ is shown to be $\frac{1}{2}$.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[105]

[2] \$6.85, and appropriate work is shown.
[1] The correct rate for the first 5 minutes and the correct rate for each additional minute is shown, but the cost of a 30-minute call is not found.
or [1] Appropriate work is shown, but one computational error is made.
or [1] \$6.85, but no work is shown.
[0] The student calculates either the rate for the first 5 minutes or the rate for each additional minute, but no further work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[106]

[2] 2, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 2, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[107]

[2] 16.6, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] A correct substitution of 4.75 for t is made, but no further correct work is shown.
or [1] 16.6, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[108]

[2] –17, and appropriate work is shown.
[1] Appropriate work is shown, but one conceptual error or one computational or graphing error is made.
or [1] –17, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[109]

[2] 25, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] The solution is incomplete, such as only the correct percent is shown.
or [1] 25, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[110]

[2] $\frac{40}{243}$ or an equivalent fraction or .1646, and appropriate work is shown, such as ${}_5C_3(\frac{1}{3})^3(\frac{2}{3})^2$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as finding the probability of choosing at least three even-numbered channels.
or [1] $\frac{40}{243}$ or an equivalent fraction or .1646, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[111]

[2] 164.2, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] 164.2, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[112]

[2] $\frac{15{,}120}{78{,}125}$ or 19.35% or an equivalent answer, and appropriate work is shown, such as ${}_7C_3(.6)^3(.4)^4$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] A correct expression, such as ${}_7C_3(.6)^3(.4)^4$, is written, but no further correct work is shown.
or [1] An incorrect expression of equal difficulty is evaluated appropriately.
or
[1] $\frac{15{,}120}{78{,}125}$ or 19.35% or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[113]

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[2] Maximum, and an appropriate reason is given, such as the value of a is negative (less than 0) or the graph opens downward.
[1] Minimum, but an appropriate reason is given, based on an incorrect equation, such as an error in finding the axis of symmetry.
[0] Maximum or minimum, but no reason or an inappropriate reason is given.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[114]

[4] 91.5, and appropriate work is shown, such as using the Law of Sines to find either side of the obtuse triangle and then using the sine function to find the height of the lighthouse.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] The angles in the obtuse triangle are found incorrectly, but appropriate work is shown, and an appropriate height of the lighthouse is found.
[2] Appropriate work is shown, but more than one computational or rounding error is made.
or [2] A correct length of a side of the obtuse triangle is found, but no further correct work is shown.
[1] An appropriate equation is set up for one triangle, but it is not solved.
or [1] 91.5, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[1]

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[4] $y = 2\sin\frac{1}{2}x + 3$ or $y = -2\sin\frac{1}{2}x + 3$, and appropriate work is shown.
[3] The fact that c is equal to 3 is not recognized, resulting in an answer of $y = 2\sin\frac{1}{2}x$ or $y = -2\sin\frac{1}{2}x$.
or [3] The values of a, b, and c are determined correctly, and appropriate work is shown, but the equation is not written.
or [3] The value of a or c is determined incorrectly, but the value of b is determined correctly, and appropriate work is shown, and an appropriate equation is written.
[2] Only the value of b is determined correctly, but appropriate work is shown, and an appropriate equation is written.
or [2] Only the values of a and c are determined correctly, but appropriate work is shown, and an appropriate equation is written.
[1] The value of a or c is determined incorrectly, and the value of b is not determined or is determined incorrectly, but appropriate work is shown, and an appropriate equation is written.
or [1] $y = 2\sin\frac{1}{2}x + 3$ or $y = -2\sin\frac{1}{2}x + 3$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[2]

[4] 63, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but the supplement of the angle is found, resulting in an answer of 117.
[2] Appropriate work is shown, but more than one computational or rounding error is made.
or [2] A conceptual error is made when applying the Law of Cosines.
[1] A correctly labeled diagram is drawn, but no further correct work is shown.
or [1] 63, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[3]

[4] 5,513 and a correct diagram is drawn, and appropriate work is shown, such as using the Law of Cosines.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] 5,513, and appropriate work is shown, but no diagram is drawn.
or [3] Appropriate work is shown, but the calculations are performed in radians, resulting in an answer of 6,698.
or [3] An incorrect diagram is drawn, but an appropriate solution is found using the Law of Cosines.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Appropriate work is shown, but an incorrect substitution is made into the Law of Cosines, but an appropriate solution is found.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] Correct substitution is made into the Law of Cosines, but no further correct work is shown.
or [1] A correctly labeled diagram is drawn, but no further correct work is shown.
or [1] 5,513, but no work is shown and no diagram is drawn.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[4]

[4] (0,1) and (1,2), and a correct graph is drawn with at least one function labeled.
[3] Appropriate work is shown, but one graphing error is made, such as plotting one point incorrectly or not labeling either function.
or [3] The graphs are drawn correctly, but only one correct solution is found or only the x- or the y-values are found correctly.
[2] Appropriate work is shown, but two or more graphing errors are made.
or [2] (0,1) and (1,2), but the solution is found by a nongraphic method.
or [2] The graphs are drawn correctly, but no correct solutions are found.
[1] The graph of only one equation is drawn correctly, and no further correct work is shown.
or [1] (0,1) and (1,2), but no work is shown.
[0] (0,1) or (1,2), but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[5]

[4] 234, and appropriate work is shown, such as using the Law of Sines.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but one substitution error is made, such as using 42 as $m\angle FAB$.
or [3] Appropriate work is shown, but the correct distance to station B (180 miles) is found.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Correct substitution is made into the Law of Sines, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] 234, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[6]

[4] The scatter plot is completed correctly, and the correct regression equation is given, such as $y = (4.8)(6.8)^x$.
[3] Appropriate work is shown, but one graphing or rounding error is made.
[2] The scatter plot is completed correctly, but the coefficients of the regression equation are transposed.
or [2] The scatter plot is inaccurate, but the correct regression equation is given.
[1] No scatter plot is drawn, but the correct regression equation is given.
or [1] The scatter plot is completed correctly, but no regression equation is given.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[7]

[4] 2, and appropriate work is shown, such as determining that the 108 square feet and the new length of *AB* is 16 feet.
[3] Appropriate work is shown, but one computational error is made.
or [3] The area of the original triangle and the new length of side *AB* are found correctly, but the length is not subtracted to find the difference.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Appropriate work is shown, but one computational error is made, and the length is not subtracted to find the difference.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] The area of the original triangle is found correctly, but no further correct work is shown.
or [1] 2, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[8]

[4] $\frac{51}{243}$, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
[2] Appropriate work is shown, but the probabilities for the teams are switched.
or [2] Correct substitution is made, but no further work is shown.
or [2] Correct substitution is made, but an incorrect mathematical operation is used, such as multiplication instead of addition.
or [2] The probability for "at most three" or "more than 3" is found, but appropriate work is shown.
[1] $\frac{40}{243}$, and exactly three games are shown.
or [1] $\frac{51}{243}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[9]

[4] 16.2 and 10, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but the sample standard deviation (s) is used, resulting in answers of 16.7 and 10.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] 16.2 and 10, but no work is shown.
[0] 16.2 or 10, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[10]

[4] f($x$) = 98.8571$x$ + 737.3333 or $y$ = 98.8571$x$ + 737.3333 and day 14, and appropriate substitution is made, such as 2050 = 98.8571$x$ + 737.3333.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] A correct linear regression equation is written and day 14, but no substitution is made.
or [3] The expression 98.8571$x$ + 737.3333 is written and day 14, and appropriate substitution is made, but no equation is written.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] A correct linear regression equation is written, but no further correct work is shown.
or [2] An incorrect equation of equal difficulty is solved appropriately.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] The expression 98.8571$x$ + 737.3333 is written, but no further correct work is shown.
or [1] Day 14, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[11]

[4] $\frac{\pi}{6}$ and $\frac{5\pi}{6}$ and 10, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] $x$ = 0.52 and $x$ = 2.62 or $x$ = 30° and $x = 150°$ and 10, and appropriate work is shown.
or [3] $\frac{\pi}{6}$ and $\frac{5\pi}{6}$, and appropriate work is shown, but the maximum height is missing.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] $x$ = 0.52 and $x$ = 2.62 or $x$ = 30° and $x = 150°$, and appropriate work is shown, but the maximum height is missing.
or [2] $\frac{\pi}{6}$ or $\frac{5\pi}{6}$ and 10, and appropriate work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] 30° or 150° and 10, and appropriate work is shown.
or [1] $\frac{\pi}{6}$ and $\frac{5\pi}{6}$ and 10, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[12]

[4] Maximum height = 64 and time = 4, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or graphing error is made.
or [3] The correct time is found, and appropriate work is shown, but the maximum height is not found.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The maximum height is found correctly, and appropriate work is shown, but an incorrect value is found for *t*.
or [2] Appropriate work is shown, but only the time that the maximum height occurs is found, and the quadratic equation $64t - 16t^2 = 0$ is factored, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [1] Appropriate work is shown, but only the time that the maximum height occurs is found, or the quadratic equation $64t - 16t^2 = 0$ is factored.
or [1] Maximum height = 64 and time = 4, but no work is shown.
[0] Maximum height = 64 or time = 4, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[13]

[4] Time of maximum height = 2.45, maximum height = 31.39, time when it hit the ground = 4.98, and appropriate algebraic or graphic work is shown. [Answers for time, in seconds, may vary based on method of solution.]
[3] Appropriate algebraic or graphic work is shown, but one computational or graphing error is made.
or [3] The times are found correctly, but the maximum height is incorrect.
[2] The rock's maximum height and the time it takes to reach that height are found correctly, but the time it takes to hit the ground is incorrect.
or [2] The time it takes the rock to hit the ground is found correctly, but the maximum height and the time it takes to reach that height are incorrect.
[1] Time of maximum height = 2.45, maximum height = 31.39, time when it hit the ground = 4.98, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[14]

[4] 29 hammers to make a profit and 45 hammers to make a profit of $100, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Either the number of hammers to make a profit or the number of hammers to make a profit of $100 is determined correctly, and appropriate work is shown.
[1] One conceptual and one computational error are made.
or [1] The correct equation and inequality or the correct equations are written, but no further correct work is shown.
or [1] 29 hammers to make a profit and 45 hammers to make a profit of $100, but no work is shown.
[0] 29 and 45, but no work is shown and the answers are not labeled.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[15] obviously incorrect procedure.

[4] $(0,0)$ and $(\frac{1}{2},\frac{1}{2})$, and both graphs are drawn correctly.
[3] Both graphs are drawn correctly, but one or both points of intersection are stated incorrectly.
or [3] The graph of $y = 2x^2$ is incorrect, but the inverse is appropriate or correct, and the appropriate points of intersection are stated correctly.
[2] Both points of intersection are found correctly, using an algebraic solution.
or [2] The graph of $y = 2x^2$ is incorrect, but the inverse is appropriate or correct, but no further work is shown.
or [2] The graph of $y = 2x^2$ is correct, but the inverse is incorrect, but the appropriate points of intersection are stated.
or [2] The graph of $y = 2x^2$ is incorrect, but the inverse is correct, but the points of intersection are not stated or are incorrect.
[1] Both graphs are incorrect, but the points of intersection are appropriate, based on the incorrect graphs.
or [1] The graph of $y = 2x^2$ is correct, but the inverse is incorrect, and the points of intersection are labeled or stated incorrectly.
or [1] $(0,0)$ and $(\frac{1}{2},\frac{1}{2})$, but no work is shown.
[0] Straight lines are used as graphs of the functions.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[16] obviously incorrect procedure.

[4] The side equals 2.3 and the area equals 25.5, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but one incorrect formula is used, such as using an incorrect trigonometric function, but appropriate answers are found.
or [2] Appropriate work is shown to find the correct side, but no further correct work is shown.
[1] The radius equals 3 and the central angle equals 45°, but no further correct work is shown.
or [1] The side equals 2.3 and the area equals 25.5, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[17]

[4] 14,000, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] A correct equation such as $\log\frac{1}{5} = (\frac{t}{6{,}000})\log 0.5$ is written, but no further correct work is shown.
[1] The correct substitutions are made, but no further correct work is shown.
or [1] 14,000, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[18]

[4] 94, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Appropriate work is shown, and the correct radian value is found for è, but it is not converted to degrees.
or [2] Both formulas are set up correctly, but no further correct work is shown.
or [2] An incorrect radian value is found for è, but it is converted correctly to degrees.
[1] Only one formula is set up correctly, and no further correct work is shown.
or [1] 94, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[19]

[4] Two, and the paths are sketched and labeled correctly, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or graphing error is made, but the appropriate number of points of intersection is stated.
or [3] Only one path is sketched correctly, but the correct interval is used, and an appropriate number of points of intersection is stated.
or [3] The paths are sketched correctly, but an incorrect interval is used, but the appropriate number of points of intersection is stated.
or [3] The paths are sketched correctly in the correct interval, but the number of points of intersection is not stated or is stated incorrectly.
[2] Appropriate work is shown, but more than one computational or graphing error is made, but the appropriate number of points of intersection is stated.
or [2] Only one path is sketched correctly in the correct interval, and the number of points of intersection is not stated or is stated incorrectly.
or [2] Only one path is sketched appropriately in an incorrect interval, but an appropriate number of points of intersection is stated.
[1] A basic sine and cosine curve are sketched, but they do not have the correct traits of the equation, but an appropriate number of points of intersection is stated.
or [1] One path is sketched correctly in the correct interval, but the second graph is not sketched.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[20]

[4] $\bar{x} = 5.5$, $\sigma = 0.5$, and the range is 4–7, and appropriate work is shown.
[3] $\bar{x} = 5.5$, $\sigma = 0.5$, but one computational error is made when finding the range, but appropriate work is shown.
or [3] $\bar{x}$ is correct, but $\sigma$ is incorrect, but the range is appropriate, based on the incorrect $\sigma$.
or [3] $\bar{x}$ is incorrect, but $\sigma$ and the range are appropriate, based on the incorrect $\bar{x}$.
[2] $\bar{x}$ is incorrect and $\sigma$ is incorrect, but the range is appropriate, based on the incorrect $\bar{x}$ and $\sigma$.
or [2] $\bar{x}$ is correct and $\sigma$ is correct, but the range is not determined.
[1] $\bar{x} = 5.5$, $\sigma = 0.5$, and the range is 4–7, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[21]

[4] $(f \circ g)(x) = 4x^{-\frac{1}{3}}$ or $(8x^{-\frac{1}{2}})^{\frac{2}{3}}$ or an equivalent answer and $(f \circ g)(27) = \frac{4}{3}$ or an equivalent answer, and appropriate work is shown.

[3] Simplification is shown to at least $4x^{-\frac{1}{3}}$, but one computational error or an error in the Law of Exponents is made when finding $(f \circ g)(27)$.

[2] $(f \circ g)(x)$ is determined correctly, but $(f \circ g)(27)$ is not found or is found incorrectly.

or [2] $\frac{4}{3}$ or an equivalent answer, and appropriate work is shown, but an expression for $(f \circ g)(x)$ is not found or is found incorrectly.

[1] $4x^{-\frac{1}{3}}$ and $\frac{4}{3}$ or equivalent answers, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[22]

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[4] Yes, and appropriate work is shown, and an appropriate justification is given.

[3] Appropriate work is shown, and an appropriate justification is given, but one computational error is made, or the negative value of t is not rejected.

[2] An appropriate graph or equation is shown, such as $16t^2 - 8t - 15 = 0$.

[1] An incorrect graph or equation of equal difficulty is used, but an appropriate solution is found.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[23]

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[4] 21 by 23, and appropriate work is shown, such as solving the equation 765 = 3(x – 4)(x – 6).

[3] Appropriate work is shown, but one computational error is made.
or
[3] Appropriate work is shown, but only one dimension is found.

[2] Appropriate work is shown, but two or more computational errors are made.
or
[2] Appropriate work is shown, but one conceptual error is made.
or
[2] An incorrect equation of equal difficulty is solved appropriately, and appropriate dimensions are found.
or
[2] A correct quadratic equation is written in standard form, but no further correct work is shown.

[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or
[1] An incorrect equation of equal difficulty is written, and one computational error is made, but appropriate dimensions are found.
or
[1] An incorrect equation of equal difficulty is solved appropriately, but one computational error is made when finding the length.
or
[1] 21 by 23, but no work is shown.

[0] 21 or 23, but no work is shown.
or
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[24]

[4] 4.1 and the equation $T = 8 \cos t + 78$ is graphed correctly and appropriate work is shown to determine the amount of time, such as using the table function of the graphing calculator or estimating (3.9–4.3 hours) based on the graph.
[3] The equation $T = 8 \cos t + 78$ is graphed correctly and the correct intervals are stated, but the number of hours is not found or is incorrect.
[2] The equation $T = 8 \cos t + 78$ is graphed correctly, but no further correct work is shown.
or [2] The equation $T = 8 \cos t + 78$ is graphed incorrectly, but an appropriate number of hours is found, based on the incorrect graph.
[1] 4.1, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[25]

[4] 10 and 1975, 1985, and 1995, and appropriate work is shown or an appropriate explanation is written.
[3] Appropriate work is shown, but one computational or graphing error is made.
or [3] 10, and appropriate work is shown, but only two of the years are found.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as graphing an incorrect function.
or [2] An incorrect equation of equal difficulty is solved appropriately.
or [2] 1975, 1985, and 1995, and appropriate work is shown or an appropriate explanation is written, but the minimum snowfall is not found.
[2] 10, and appropriate work is shown, but only one of the years is found.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [1] 10, and appropriate work is shown or an appropriate explanation is written, but the years are not found.
or [1] 10 and 1975, 1985, and 1995, but no work is shown.
[0] 10 or 1975, 1985, and 1995, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[26]

[4] 3.1, and appropriate work is shown, such as $5 = 10(0.8)^t$.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] An incorrect value for A is used, but the equation is solved appropriately.
[2] An incorrect value for A is used, but the equation is solved appropriately, but one computational or rounding error is made.
[1] 3.1, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[27]

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[4] $\frac{1}{2}$ or 50%, $\frac{15.9}{100}$ or 0.159, and $\frac{0.159}{0.977}$ or an equivalent answer, and appropriate work is shown.
[3] Correct answers are found for either part a or part b and for part c.
[2] Correct answers are found for part a and part b, but the answer for part c is missing or is incorrect.
or [2] Only the correct answer for part b is found, and one computational or substitution error is made in determining the answer to part c.
[1] Only the correct answer for either part a or part b is found.
or [1] $\frac{1}{2}$ or 50%, $\frac{15.9}{100}$ or 0.159, and $\frac{0.159}{0.977}$ or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[28]

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[4] $y = 451.431x^{-0.243}$ and 272, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] $y = 451.431x^{-0.243}$, but 7, instead of 8, is substituted for $x$ to find the number of new cases.
or [3] $y = 451.431x^{-0.243}$ and 272, but no work is shown to find the number of cases.
or [3] The expression $451.431x^{-0.243}$ is written, and appropriate work is shown to find 272, but no equation is written.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The correct regression equation is written, but no further correct work is shown.
or [2] An incorrect regression equation of equal difficulty is solved appropriately for the number of new cases, and appropriate work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] An incorrect regression equation of a lesser degree of difficulty is solved appropriately for the number of new cases, and appropriate work is shown.
or [1] The expression $451.431x^{-0.243}$ is written, but no further correct work is shown.
or [1] 272, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[29]

[4] 2 ± i, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made, but the result is expressed as a complex number in simplest a + bi form.
or [3] Appropriate work is shown, but the roots are not expressed in simplest a + bi form.
or [3] Appropriate work is shown, but only one complex root, in simplest a + bi form, is found.
[2] Appropriate work is shown, but one computational error is made, resulting in a solution that is not a complex number.
or [2] Appropriate work is shown, but two or more computational errors are made, but the result is expressed as a complex number in simplest a + bi form.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] An incorrect quadratic formula is used, but the result is expressed as a complex number in simplest a + bi form.
[1] Incorrect substitution is made into the quadratic formula, such as a = 1, b = 5, and c = –4, but the resulting equation is solved appropriately.
or [1] 2 ± i, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[30]

[4] .08 and .07, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] The probability that at least four students will be on a team is found correctly, and appropriate work is shown, but the probability that exactly one student will not be on a team is not found or is found incorrectly.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as finding the probability that at most four or exactly four students will be on the team.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] The probability that at least one student will not be on a team is found correctly, and appropriate work is shown, but the probability that at least four students will be on a team is not found.
or [1] .08 and .07, but no work is shown.
[0] .08 or .07, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[31]

[4] A complete and correct proof that includes a concluding statement is written.
[3] A proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one reason is missing or is incorrect or the concluding statement is missing.
or [3] Two pairs of angles are proven congruent, but the triangles are not proven similar.
[2] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two statements or reasons are missing or are incorrect.
or [2] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made, such as using an incorrect method to prove that two angles are congruent.
or [2] $\angle E$ and $\angle ABC$ are proven congruent, but the remainder of the proof is missing or is incorrect.
[1] Some correct relevant statements about the proof are made, such as showing that $\angle CAB$ and $\angle ABE$ are congruent, but the remainder of the proof is missing or is incorrect.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[32]

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[4] 3 and $\frac{1}{2}$, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but only one of the values is found.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The correct quadratic equation is written in standard form, but no further correct work is shown.
or [2] An incorrect quadratic equation of equal difficulty is solved appropriately.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] An incorrect equation of a lesser degree of difficulty is solved appropriately.
or [1] 3 and $\frac{1}{2}$ but no work is shown.
[0] 3 or $\frac{1}{2}$, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[33]

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[4] $\bar{x} = 80$, $\bar{y} = 20.8$, and $y = 0.25x + 0.8$, and appropriate work is shown to prove that ($\bar{x}$, $\bar{y}$) is a point on the line of regression.
[3] Appropriate work is shown, but one computational error is made.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
[1] $\bar{x} = 80$, $\bar{y} = 20.8$, and $y = 0.25x + 0.8$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[34]

[4] Both equations are graphed correctly over the specified domain and the interval $-\frac{\pi}{3} \le x \le \frac{\pi}{3}$ is identified.
[3] Appropriate work is shown, but one computational or graphing error is made.
or [3] Both equations are graphed correctly over the specified domain, but the interval is not identified or is written as -1.0472 ≤ x ≤ 1.0472 or -60° ≤ x ≤ 60° or $-\frac{\pi}{3} < x < \frac{\pi}{3}$.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as graphing y = 4 sin x.
or [2] The equation y = 4 cos x is graphed correctly over the specified domain, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [1] $-\frac{\pi}{3} \le x \le \frac{\pi}{3}$, but no work is shown and no graphs are drawn.
[0] The equation y = 2 is graphed correctly, but no further correct work is shown.
or [0] -1.0472 < x < 1.0472 or -60° < x < 60° or $-\frac{\pi}{3} < x < \frac{\pi}{3}$, and no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[35]

[4] 65.27, and appropriate work is shown, such as $\frac{100}{\sin 100} = \frac{x}{\sin 40}$.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but calculations are performed in radians, resulting in an answer of –147.15.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as the use of an incorrect trigonometric function.
or [2] An incorrect diagram is drawn, but appropriate work is shown, and an appropriate answer is found.
[1] A correctly labeled diagram is drawn, but no further correct work is shown.
or [1] 65.27, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[36]

[4] An appropriate diagram is drawn, and a correct proof is written in statement-reason or paragraph form, such as stating that $\Delta AOB$ cannot have two right angles or that two perpendiculars cannot be drawn to $\overline{PA}$ from point $O$.
[3] An appropriate diagram is drawn and an appropriate reason is written to show $\overline{OA} \perp \overline{PA}$, but one statement or one reason is incomplete or is incorrect, but an appropriate conclusion is drawn.
or [3] The diagram is not drawn, but a complete and correct proof is written.
[2] An appropriate diagram is drawn, and an appropriate reason is written to show $\overline{OA} \perp \overline{PA}$, but one statement and one reason are incomplete or are incorrect, but an appropriate conclusion is drawn.
[1] An appropriate diagram is drawn, but the proof contains circular reasoning.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[37]

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[4] a $y = 0.8344648562x + 14.64960064$ or an equivalent answer expressed to three significant digits
and b 80, and appropriate work is shown.
[3] One computational error is made or one rounding error is made with one of the numbers in the equation, such as truncating or not giving at least three significant digits.
[2] Only the correct answer for either part a or part b is found.
or [2] Appropriate work is shown, but more than one computational or rounding error is made.
[1] 78 is substituted into an incorrect linear equation, but it is evaluated appropriately.
or [1] $y = 0.8344648562x + 14.64960064$ and 80, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[38]

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[4] $3.8 \le x \le 15.2$, and appropriate work is shown, such as using the quadratic formula or sketching the graph of the parabola and the line.
[3] Appropriate work is shown, but one computational, rounding, or graphing error is made.
or [3] $3.8 < x < 15.2$, and appropriate work is shown.
[2] Appropriate work is shown, but two or more computational, rounding, or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The graph of the parabola and the line are sketched correctly, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational, rounding, or graphing error are made.
or [1] Correct substitution is made into the quadratic formula, but no further correct work is shown.
or [1] The graph of the parabola is sketched correctly, but no further correct work is shown.
or [1] $3.8 \le x \le 15.2$, but no work is shown.
[0] $3.8 < x < 15.2$, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[39]

[4] 16,600 and 11.3, and appropriate work is shown.
[3] Appropriate work is shown, but one computational, rounding, or graphing error is made.
[2] Appropriate work is shown, but two or more computational, rounding, or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Either 16,600 or 11.3 is found, and appropriate work is shown, but the other answer is not found.
[1] Appropriate work is shown, but one conceptual error and one computational, rounding, or graphing error are made.
or [1] Correct substitutions are made into both formulas, but no further correct work is shown.
or [1] 16,600 and 11.3, but no work is shown.
[0] 16,600 or 11.3, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[40] obviously incorrect procedure.

[4] 60°, and an appropriate sketch is drawn, and appropriate work is shown.
[3] A correct sketch is shown, and $m\overset{\frown}{AB}$ is correct.
or [3] A correct sketch is shown, but one computational error is made, leading to an incorrect $m\overset{\frown}{AB}$, but $m\overset{\frown}{CB}$ is appropriate, based on the incorrect $m\overset{\frown}{AB}$.
[2] A correct sketch is shown, but an incorrect procedure is used to find either the correct or incorrect $m\overset{\frown}{AB}$, but $m\overset{\frown}{CB}$ is appropriate, based on the incorrect $m\overset{\frown}{AB}$.
or [2] An incorrect sketch is shown, but an appropriate $m\overset{\frown}{CB}$ is found, based on the incorrect sketch.
[1] Only a correct sketch is shown.
or [1] 60°, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[41] incorrect procedure.

[4] $\frac{-3\pm\sqrt{37}}{7}$ or an equivalent answer, and appropriate work is shown.
[3] A correct quadratic equation is written and appropriate work is shown, but one computational or simplification error is made.
or [3] An incorrect quadratic equation of equal difficulty is solved appropriately.
[2] A correct quadratic equation is written and appropriate work is shown, but two or more computational or simplification errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] A correct quadratic equation is written in standard form, but no further correct work is shown.
[1] An incorrect equation of a lesser degree of difficulty is solved appropriately.
or [1] $\frac{-3\pm\sqrt{37}}{7}$ or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[42]

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[4] 174, and appropriate work is shown, such as the use of the Law of Cosines.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] One conceptual error is made when applying the Law of Cosines, but an appropriate answer is found.
[1] Correct substitution is made into the Law of Cosines, but no further correct work is shown.
or [1] 174, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[43]

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[4] $y = 1{,}018.2839(0.5969)^x$ and 16, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] $y = 1{,}018.2839(0.5969)^x$ and 16, but the substitution is not shown.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] An appropriate regression equation is written, but the number of coins returned after the eighth trial is not found.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] An incorrect regression equation is written, but the number of coins returned after the eighth trial is found appropriately.
or [1] $y = 1{,}018.2839(0.5969)^x$ and 16, but no work is shown.
[0] $y = 1{,}018.2839(0.5969)^x$ or 16, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[44]

[4] The function is graphed over the specified interval, and 96, and appropriate work is shown, such as calculating the revenue at 95 and 96 to show that 96 will make the hotel profitable or writing an explanation.
[3] Appropriate work is shown, but one computational, graphing, or rounding error is made.
[2] Appropriate work is shown, but two or more computational, graphing, or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] 96, and appropriate work is shown, but no graph is drawn.
or [2] The function is graphed correctly, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational, graphing, or rounding error are made.
or [1] 96, but no work is shown and no graph is drawn.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[45]

[4] (0,-3) and (1,0) or an equivalent answer, and appropriate algebraic work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but only one correct solution is found or only the *x*- or the *y*-values are found correctly.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] (0,-3) and (1,0), but a method other than an algebraic solution is used.
or [2] A correct quadratic equation is written in standard form, such as $18x^2 - 18x = 0$, but no further correct work is shown.
or [2] An incorrect quadratic equation of equal difficulty is solved appropriately.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] An incorrect equation of a lesser degree of difficulty is solved appropriately.
or [1] $y = 3x-3$ is found and substituted into the second equation, but no further correct work is shown.
or [1] (0,-3) and (1,0), but no work is shown.
[0] Only one correct solution is found or only the *x*- or the *y*-values are found correctly, and no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[46]

[4] Appropriate work is shown, and an appropriate concluding statement is made to prove quadrilateral *ABCD* is a rhombus.
[3] The proof is completed appropriately, but one computational error is made, but an appropriate concluding statement is made.
or [3] Appropriate work is shown to prove quadrilateral *ABCD* is a rhombus, but the concluding statement is missing, incomplete, or incorrect.
[2] The proof is completed appropriately, but more than one computational error is made, but an appropriate concluding statement is made.
or [2] Appropriate work is shown, but one of the formulas used is incorrect.
or [2] Appropriate work is shown to prove quadrilateral *ABCD* is a parallelogram, and an appropriate concluding statement is made, but the sides are not proved to be equal.
or [2] Quadrilateral *ABCD* is proved to be a rhombus by assuming quadrilateral *ABCD* is a parallelogram.
[1] Appropriate work is shown to prove quadrilateral *ABCD* is a parallelogram, and the concluding statement is missing, incomplete, or incorrect.
or [1] The definition of a rhombus is stated, but no proof is given.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[47]

[4] 720,500 is the population in 1980, 1.022 represents a growth rate of 2.2% added to the current population, and the population will reach the given number in 2015, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] 720,500 and 1.022 are explained correctly, and 2015 is found as the year, but no work is shown to indicate how the year was obtained.
or [3] Either 720,500 or 1.022 is explained correctly, and 2015 is found as the year, and appropriate work is shown.
or [3] 720,500 and 1.022 are explained correctly, but 35.167 years is found as an answer, but appropriate work is shown.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] 720,500 and 1.022 are not explained or are explained incorrectly, but 2015 is found as the year, and appropriate work is shown.
or [2] 720,500 and 1.022 are explained correctly, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] Either 720,500 or 1.022 is explained correctly, but no further correct work is shown.
or [1] 35.167 or 35 years, and appropriate work is shown, but the year is not found, and no explanations or incorrect explanations are given.
or [1] 2015, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[48]

[4] 5, and appropriate algebraic work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] 5 and 0, and appropriate work is shown, but the zero is not rejected.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as squaring $x-1$ incorrectly.
or [2] 5, but a method other than an algebraic solution is used, such as graphing or trial and error with at least three trials and appropriate checks.
or [2] A correct quadratic equation is written in standard form, such as $0 = x^2 - 5x$, but no further correct work is shown.
or [2] An incorrect quadratic equation of equal difficulty is solved appropriately.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] An incorrect equation of a lesser degree of difficulty is solved appropriately.
or [1] 5, but no work is shown.
[0] 5 and 0, and no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[49]

[4] 11, and appropriate work is shown, such as a logarithmic equation or a graph.
[3] Appropriate work is shown, but one computational, rounding, or graphing error is made.
[2] Appropriate work is shown, but two or more computational, rounding, or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] A correct logarithmic equation is written, but no further correct work is shown.
or [2] A correct graph is drawn, but the solution is not found or is found incorrectly.
[1] Appropriate work is shown, but one conceptual error and one computational, rounding, or graphing error are made.
or [1] 11, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[50]

[4] 32.8, and appropriate work is shown.
[3] Appropriate work is shown, but one computational, rounding, or graphing error is made.
or [3] An incorrect substitution is made, but appropriate work is shown and an appropriate solution is found.
[2] Appropriate work is shown, but two or more computational, rounding, or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as incorrect application of a logarithm rule.
[1] Correct substitutions are made, but no further correct work is shown.
or [1] 32.8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[51]

[4] 12.6, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but the quadratic formula is incorrect.
[2] An appropriate equation is shown and put in standard form, but the quadratic formula is not used correctly.
or [2] An appropriate equation is shown and put in standard form, but no further work is shown.
or [2] Appropriate work is shown, but more than one computational error or one computational and one rounding error are made.
[1] An appropriate equation is shown, but all other work is missing or is incorrect.
or [1] 12.6, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[52]

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[4] $(x-20)^2+(y-8)^2=16$ and the ellipse is sketched correctly.
[3] Appropriate work is shown, but one computational or graphing error is made.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The equation of the circle is written correctly or the ellipse is sketched correctly, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[53]

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[4] $\frac{1,472}{78,125}$, and appropriate work is shown, such as ${}_7C_6(\frac{2}{5})^6(\frac{3}{5})^1+{}_7C_7(\frac{2}{5})^7(\frac{3}{5})^0$.
[3] Appropriate work is shown, but one computational error is made.
or [3] The probabilities for exactly six times and exactly seven times are calculated correctly, but they are not added.
or [3] The probability for at most six times is calculated correctly.
[2] Appropriate work is shown, but more than one computational error is made.
or [2] Appropriate work is shown, but one conceptual error is made, such as multiplying the probabilities.
[1] A correct expression is written for finding the probability, but no further correct work is shown.
or [1] The probability for exactly six times is calculated correctly.
or [1] $\frac{1,472}{78,125}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[54]

[4] A correct graph is sketched and 1.25, and appropriate work is shown.
[3] A correct graph is sketched, but one computational or rounding error is made in determining the time.
or [3] Appropriate work is shown, but one error is made in sketching the graph, such as the axes are not labeled or are labeled incorrectly, but the time is determined correctly.
or [3] A correct graph is sketched and appropriate work is shown to calculate the time, but the negative root is not rejected.
[2] Appropriate work is shown, but two or more computational, rounding, or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] A correct graph is sketched, but no further correct work is shown.
or [2] Appropriate work is shown to calculate the time, but no graph or an incorrect graph is sketched.
[1] Appropriate work is shown to calculate the time, but one computational or rounding error is made, and no graph or an incorrect graph is sketched.
or [1] Appropriate work is shown to calculate the time, but the negative root is not rejected, and no graph or an incorrect graph is sketched.
or [1] 1.25, but no graph or an incorrect graph is sketched, and no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[55]

[4] 90 and 270, and appropriate work is shown, such as solving $\sin^2\theta = 1 + \cos\theta$.
[3] Appropriate work is shown, but one computational error is made or the answers are expressed in radians.
or [3] Appropriate work is shown, but 180 is not rejected as a solution.
or [3] Appropriate work is shown, but only one solution is found.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] An incorrect trigonometric substitution is made, but the equation is solved appropriately.
or [2] A trigonometric equation set equal to zero is written, but no further correct work is shown.
or [2] 90 and 270, but a graphic solution is provided.
[1] The equation $\sin^2\theta - \cos\theta - 1 = 0$ is found, but no further correct work is shown.
or [1] A graphic solution is provided, and one computational or graphing error is made.
or [1] 90 and 270, but no work is shown.
[0] 90 or 270, but no work is shown.
or [0] 90, 180, and 270, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[56]

[4] A correct graph is drawn, and 3.
[3] 3, and appropriate work is shown, but one graphing error is made.
or [3] A correct graph is drawn and the points 0.5 and 3.5 are identified, but the difference is not calculated.
[2] Appropriate work is shown, but two or more graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] 3, but a method other than a graphic solution is used.
[1] Appropriate work is shown, but one conceptual error and one graphing error are made.
or [1] A correct graph is sketched with $t = 0$ to $t = 4$, but no further correct work is shown.
or [1] 3, but no work is shown and no graph is drawn.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[57]

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[4] 0.15 hour or 9 minutes or an appropriately rounded answer, and appropriate work is shown, such as using the Law of Cosines.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] The correct distance along County Route 21 is found, but no further work or incorrect work is shown.
or [2] Appropriate work is shown, but one computational and one rounding error are made.
[1] The Pythagorean theorem is used to find the distance along County Route 21, and this distance is used to compare travel times.
or [1] 0.15 hour or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[58]

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[4] Appropriate work is shown to explain why or prove the triangles are congruent.
[3] An explanation is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one reason is missing or is incorrect.
[2] An explanation is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.
[1] Some correct relevant statements about the method of proof are made, but two or three statements or reasons are missing or are incorrect.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[59]

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[4] $\frac{41}{59{,}049}$, and appropriate work is shown, such as ${}_5C_5(\frac{1}{9})^5 + {}_5C_4(\frac{1}{9})^4(\frac{8}{9})^1$.
[3] Appropriate work is shown, but one computational error is made.
or [3] The combination includes an incorrect setup for determining the probability of hitting the bull's-eye five times but a correct setup for determining the probability of hitting the bull's-eye four times, but an appropriate probability is found.
[2] The probability of "exactly 4" is found.
or [2] The probability of "at most 3" is found.
[1] A probability of $\frac{1}{9}$ is found, based on the area of the two circles.
or [1] $\frac{41}{59{,}049}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[60]

[4] $y = -34739.71292x + 313309.0909$ and 209,090, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] An incorrect linear equation with a negative slope is written, but an appropriate price is found for three blocks from the beach.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] A correct linear function is written, but no further correct work is shown.
or [2] An incorrect linear equation with a positive slope is written, but an appropriate price is found for three blocks from the beach.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] 209,090, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[61]

[4] $\frac{51}{243}$ or an equivalent answer, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as finding the probability for *at most* three times.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] An incorrect expression of a lesser degree of difficulty is evaluated appropriately, such as finding the probability for *exactly* three times.
or [1] $\frac{51}{243}$ or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[62]

[4] A correct table of values is provided, a correct graph is drawn, and 670; 12, and appropriate work is shown, such as extending the graph or solving algebraically.
[3] Appropriate work is shown, but one computational or graphing error is made.
or [3] A correct table of values is provided, a correct graph is drawn, and 670, but no further correct work is shown.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] 670 and 12, but an algebraic solution is provided.
or [2] 670 and 12, but either the graph is not drawn or the table of values is not provided.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [1] A correct graph is drawn, but no further correct work is shown.
or [1] A correct table of values is provided, but no further correct work is shown.
or [1] 670 and 12, but no work is shown and no graph is drawn.
[0] 670 or 12, but no work is shown and no graph is drawn.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[63]

[4] 88, and appropriate work is shown, such $\frac{y}{\sin 32} = \frac{100}{\sin 33}$ and $\sin 65 = \frac{x}{y}$.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as setting up an incorrect proportion.
or [2] The hypotenuse of one of the right triangles is found correctly, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] The obtuse triangle is treated as a right triangle, but an appropriate height is found for the tower.
or [1] 88, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[64]

[4] Both equations are graphed correctly and the description of the transformation $a \rightarrow b$ is correct, such as $T_{(4,3)} \circ r_{x-axis}$ or $r_{y=3} \circ T_{(4,3)}$ or $T_{(4,3)} \circ R_{180°}$ or an equivalent explanation, such as a shift right of 4 followed by a reflection over the x-axis followed by a shift up of 3.
[3] Both equations are graphed correctly, but only one transformation is shown or described correctly.
[2] Both equations are graphed correctly, but no further correct work is shown.
[1] Only one equation is graphed correctly, and no composition formula or explanation is shown.
or [1] The correct composition formula or explanation is shown, but no graphs or incorrect graphs are drawn.
or [1] Both equations are graphed incorrectly, but an appropriate composition formula or explanation is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[65]

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[4] 4.27, and appropriate work is shown, such as solving the equation $(9 + x)(12 + x) = 216$.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but the negative root is not rejected.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] A correct equation is written in standard form, but no further correct work is shown.
or [2] An incorrect quadratic equation of equal difficulty is solved appropriately.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] An incorrect quadratic equation of a lesser degree of difficulty is solved appropriately.
or [1] 4.27, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[66]

[67]

[4] 4.5, and appropriate work is shown, such as using logs to solve the equation $0.2 = 0.7^t$.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Substitution with r = 30 is shown and the log of both sides is determined, but the domain error is not recognized, such as $\log 0.2 = t \log(-29)$.
or [2] The order of operations is used incorrectly and an exponential function is maintained, but t is solved for appropriately, using logs.
[1] Substitution with r = 0.3 is shown, resulting in $0.2 = 0.7^t$, but no further work is shown.
or [1] 4.5, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[68]

[4] 6.8, and appropriate work is shown, such as using the Law of Cosines or the Law of Sines or right triangle trigonometry.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] 3.4, and appropriate work is shown, such as $\cos 70 = \frac{x}{10}$ or $\sin 20 = \frac{x}{10}$.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as using an incorrect trigonometric function.
or [2] Correct substitution is made into the Law of Sines or the Law of Cosines, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] The measures of $\overset{\frown}{EA}$ and $\overset{\frown}{SA}$ are found correctly, but no further correct work is shown.
or [1] The measures of the three angles of triangle *SEA* are found correctly, but no further correct work is shown.
or [1] 6.8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[4] $1 \le t \le 3$, and appropriate work is shown, such as $-16t^2 + 64t + 4 \ge 52$.
[3] Appropriate work is shown, but one computational error is made.
or [3] An incorrect inequality is written, but the resulting quadratic inequality is solved appropriately.
[2] Appropriate work is shown, but more than one computational error is made.
or [2] The quadratic equation $-16t^2 + 64t + 4 = 52$ is solved appropriately, and both solutions are found.
[1] An incorrect quadratic equation of equal difficulty is solved appropriately, but one computational error is made.
or [1] $1 \le t \le 3$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[69]

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[4] 60 and 104, and appropriate work is shown either algebraically or graphically.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but only one correct angle is found.
or [3] 60 and 104, and appropriate work is shown, but additional angles outside the interval are found.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] $\cos\theta = -\frac{1}{4}$ and $\cos\theta = -\frac{1}{2}$, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] 60 and 104, but no work is shown.
[0] 60 or 104, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[70]

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[4] 11,052 and 14, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] 14, and appropriate work is shown, but the amount of money he will have after 2 years is not found.
[2] Appropriate work is shown, but more than one computational or rounding error is made.
or [2] 11,052, and appropriate work is shown, and a correct log equation, such as $\log 2 = .05x \log 2.718$ is written, but it is not solved.
[1] 11,052, and appropriate work is shown, but the number of years to double his investment is not found or is found incorrectly.
or [1] Appropriate substitutions are made for both equations, but neither equation is solved.
or [1] 11,052 and 14, but no work is shown.
[0] 11,052 or 14, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[71]

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[4] $\frac{x+3}{2}$, and appropriate work is shown.
[3] Appropriate work is shown, but one computational, factoring, or simplification error is made.
[2] Appropriate work is shown, but two or more computational, factoring, or simplification errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as failing to multiply by the reciprocal of g($x$) or trying to solve for $x$.
[1] Appropriate work is shown, but one conceptual error and one computational, factoring, or simplification error are made.
or [1] $\frac{x+3}{2}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[72]

[4] 590.5 and 652.6, and appropriate work is shown, such as $|d - 620| \le 0.05d$.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] 590.5 or 652.6, and appropriate work is shown.
[1] 590.5 and 652.6, but no work is shown.
[0] 590.5 or 652.6, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[73]

[4] 4, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but $x = -1$ is not rejected.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The correct quadratic equation is written in standard form, but no further correct work is shown.
or [2] A quadratic equation of equal difficulty is solved appropriately.
[1] Both sides of the equation are squared correctly, but no further correct work is shown.
or [1] 4, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[74]

[4] Mean = 3.6, standard deviation = 2.9, and 31, and appropriate work is shown, such as an explanation of how the solutions were found.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] The mean and standard deviation are calculated correctly and appropriate work is shown, but the number of presidents in the specified interval is found incorrectly.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as using the sample standard deviation.
or [2] The mean and standard deviation are calculated correctly, but the number of presidents is not found.
or [2] The mean and standard deviation are calculated incorrectly, but an appropriate number of presidents is found.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] Mean = 3.6, standard deviation = 2.9, and 31, but no work is shown.
[0] Mean = 3.6 or standard deviation = 2.9 or 31, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[75]

[4] $-1 \pm i\sqrt{6}$, and appropriate work is shown, such as appropriately substituting for *a*, *b*, and *c* in the quadratic formula, solving the equation, and simplifying the answer correctly.
[3] Appropriate work is shown, but one computational or simplification error is made.
[2] Appropriate work is shown, but two or more computational or simplification errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as writing the quadratic formula incorrectly.
[1] Appropriate work is shown, but one conceptual error and one computational or simplification error are made.
or [1] $-1 \pm i\sqrt{6}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[76]

a [2] The equation $2y = 2x^2 - 4$ is graphed correctly over the required interval and labeled.
[1] An appropriate graph is shown, but less than the required interval is drawn.
or [1] An appropriate graph is shown, but one coordinate is calculated incorrectly.
b [2] A correct composition of transformations of the graph drawn in part a is sketched and labeled.
[1] Only one of the transformations is correct.
or [1] The composition of transformations is correct, but done in reverse order.
a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[77]

[4] 8.7 standard deviation, 70% within one standard deviation, and "Yes," and appropriate work is shown, and an appropriate justification is given.
or [4] 8.7 standard deviation, 70% within one standard deviation, and "No," and appropriate work is shown, and an appropriate justification is given.
[3] One error is made in determining the standard deviation or the percent, but all the other work is appropriate.
[2] 8.7 and 70%, and appropriate work is shown, but no justification is given.
or [2] The standard deviation is determined correctly, but more than one error is made when calculating the percent, but the justification is appropriate.
[1] The standard deviation is determined correctly, but no further work is shown.
or [1] The standard deviation is determined incorrectly, but the percent is appropriate, based on the incorrect standard deviation.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[78]

[4] 15.13, and appropriate work is shown, such as solving the equation $236.64 = \pi(4.75)\sqrt{(4.75)^2 + h^2}$.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] Correct substitution of values is made into the equation, but no further correct work is shown.
or [1] 15.13, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[79]

[4] Both parabolas are graphed correctly with the line of symmetry $x = 3.5$ drawn and labeled as $x = 3.5$.
[3] $y = -x^2 + 9$ is graphed incorrectly, but an appropriate translation is drawn, and an appropriate line of symmetry is drawn and labeled correctly.
or [3] $y = -x^2 + 9$ and its translation are graphed correctly, but no line of symmetry or an incorrect line of symmetry is drawn for the translation or no equation or an incorrect equation is shown for the line of symmetry.
[2] $y = -x^2 + 9$ is graphed correctly, but its translation is graphed incorrectly, but an appropriate line of symmetry is drawn and labeled correctly.
or [2] $y = -x^2 + 9$ is graphed incorrectly, but an appropriate translation is graphed, but an incorrect line of symmetry is drawn.
[1] $y = -x^2 + 9$ and its translation are graphed incorrectly, but an appropriate line of symmetry is drawn and labeled correctly.
or [1] $y = -x^2 + 9$ is graphed correctly, but an incorrect translation and line of symmetry are drawn.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[80]

[4] 5 and –4, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
[2] The correct log equation, $\log_4 \frac{x^2 + 3x}{x + 5} = \log_4 4$, is shown, but no further work or incorrect work is shown.
[1] One correct logarithmic step is shown, such as $\log_4 \frac{x^2 + 3x}{x + 5}$.
or [1] 5 and –4, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[81]

[4] 75, and appropriate work is shown, such as determining the mean (278.5833333) and the standard deviation for the sample (3.146667309).
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but the standard deviation for the population ($\sigma$) is used.
or [3] The mean, standard deviation for the sample, and interval are determined correctly, but an error is made in determining the percentage.
or [3] The mean and standard deviation for the sample are determined correctly, but an appropriate percentage is determined for an incorrect interval.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The mean and standard deviation for the sample are determined correctly, but no further correct work is shown.
or [2] Either the mean or the standard deviation for the sample is determined incorrectly, but an appropriate percentage is found.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] The standard deviation for the sample is determined correctly, but no further correct work is shown.
or [1] 75, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[82]

[4] $A = 1.5$, $B = 0.5$, and $D = 6.5$ or an equivalent answer, and appropriate work is shown or an appropriate explanation is given for each number found.
[3] Correct answers are found, but appropriate work is shown or an appropriate explanation is given for only two of the numbers found.
[2] Only two correct answers are found, but appropriate work is shown or an appropriate explanation is given for the two answers.
[1] Only one correct answer is found, but appropriate work is shown or an appropriate explanation is given for that answer.
or [1] $A = 1.5$, $B = 0.5$, and $D = 6.5$ or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[83]

[4] $\overline{AB}$ and $\overline{A''B''}$ are graphed and labeled correctly, $A''(0,-5)$ and $B''(-2,0)$, and a correct transformation is identified, such as $R_{180°}$, $R_{-180°}$, or $r_{(0,0)}$.

[3] One error is made in graphing $\overline{AB}$, but $\overline{A''B''}$ is graphed and labeled appropriately, and an appropriate transformation is identified.

[2] $\overline{AB}$ is graphed and labeled correctly but one mistake is made in finding $\overline{A''B''}$, but an appropriate transformation is identified.

or [2] Both $\overline{AB}$ and $\overline{A''B''}$ are graphed and labeled correctly, but the transformation is missing or is incorrect.

[1] $\overline{AB}$ is graphed and labeled correctly, but one mistake is made in finding $\overline{A''B''}$, and the transformation is missing or is incorrect.

or [1] One error is made in graphing $\overline{AB}$, but $\overline{A''B''}$ is graphed and labeled appropriately, but the transformation is missing or is incorrect.

or [1] $R_{180°}$, $R_{-180°}$, or $r_{(0,0)}$, but no graph is drawn.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[84]

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[4] 161, and appropriate work is shown, such as $500x > \frac{3{,}200{,}000}{x} + 60{,}000$.

[3] Appropriate work is shown, but one computational error is made or –40 is not rejected.

[2] A correct inequality is given in standard form, but it is not solved.

[1] An incorrect quadratic inequality of equal difficulty is solved appropriately.

or [1] 161, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[85]

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[4] The reasons for all four steps are correct, such as:
Step 3: Perpendicular line segments form right angles.
Step 6: If two parallel lines are cut by a transversal, the alternate interior angles are congruent.
Step 8: $AAS \cong AAS$.
Step 9: Corresponding parts of congruent triangles are congruent.

[3] The reasons for only three steps are correct.

[2] The reasons for only two steps are correct.

[1] The reason for only one step is correct.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[86]

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[4] 116, and appropriate work is shown.

[3] Appropriate work is shown, but one computational or rounding error is made.

or [3] Appropriate work is shown, but the supplement of the correct answer, 64, is found.

[2] Appropriate work is shown, but two or more computational or rounding errors are made.

or [2] Appropriate work is shown, but one conceptual error is made.

[1] The correct substitutions are made into the Law of Cosines, but no further correct work is shown.

or [1] 116, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[87]

[4] 3 and 42, and appropriate work is shown, such as a graph, substitution, or a table of values.
[3] Appropriate work is shown, but one computational or graphing error is made.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The number of seconds is found correctly, and appropriate work is shown, but the height is not found or is found incorrectly.
or [2] The height is found correctly, and appropriate work is shown, but the number of seconds is not found or is found incorrectly.
[1] 3 and 42, but no work is shown.
[0] 3 or 42, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[88]

[4] 210° and 330°, and appropriate work is shown.
[3] Correct substitution and factoring are shown, with at least the reference angle of 30° found.
or [3] Correct substitution is shown, and the equation is put in standard form and factored correctly, but an incorrect reference angle is used to find appropriate answers.
or [3] An incorrect quadratic equation is solved correctly, and appropriate angles are determined.
[2] Correct substitution is shown, and the equation is put in standard form and factored correctly, but no angles are found.
[1] Correct substitution is shown, but the equation is not factored or is factored incorrectly.
or [1] 210° and 330°, but no work is shown.
[0] 210° or 330° or 30°, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[89]

[4] $BC = 6.75$ and the area of $\Delta ABC$ = 16.7055 or 16.71 or an equivalent answer, and appropriate work is shown, such as using the Law of Sines and the formula for the area of a triangle.
[3] Appropriate work is shown, but one computational error is made.
[2] Only the correct length of $\overline{BC}$ is found, and appropriate work is shown.
or [2] The length of $\overline{BC}$ is found incorrectly, but an appropriate area of the triangle is found, based on the incorrect value of $\overline{BC}$.
[1] The Law of Sines is used, and appropriate substitution is made, but no further work is shown.
or [1] $BC = 6.75$ and the area of $\Delta ABC$ = 16.7055 or 16.71 or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[90]

[4] $6.15, and appropriate work is shown, such as solving simultaneous equations or using a trial-and-error method.
[3] $2.95 (movie) and $3.20 (game) are found, but they are not added.
or [3] Appropriate work is shown, but one computational error is made.
[2] The system of equations is set up correctly, but one conceptual error leads to an appropriate solution.
or [2] $2.95 (movie) or $3.20 (game), and appropriate work is shown.
[1] $6.15, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[91]

[92]

[4] 12, and appropriate work is shown, such as using the Law of Sines twice or the Law of Sines and the Law of Cosines.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] 12, but no work is shown.
[0] The Pythagorean theorem is used to solve the problem.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[93]

[4] $c(x) = 0.06x^2$ or an equivalent equation; width = $\sqrt{11.5}$ inches or an equivalent, length = $3\sqrt{11.5}$ inches or an equivalent, and height = $\frac{3}{2}\sqrt{11.5}$ inches or an equivalent, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] One or more dimensions are represented incorrectly, but all further work is appropriate.
or [3] The correct function is found and solved for x, but no further work is shown.
[2] The dimensions are represented correctly, but the equation is incorrect, but all further work is appropriate.
or [2] The dimensions are represented correctly, and the correct function is written, but further work is incomplete or is incorrect.
[1] The dimensions are represented correctly, but the function is written and solved incorrectly.
or [1] $\sqrt{11.5}, 3\sqrt{11.5},$ and $\frac{3}{2}\sqrt{11.5},$ but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[4] .7564 or an equivalent answer, and appropriate work is shown, such as finding the sum of the exact probabilities that five, six, or seven seeds will sprout.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] The probability that at most five seeds will sprout is calculated correctly, and appropriate work is shown.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The three exact probabilities are found correctly, but they are not added.
or [2] The sum of only two of the three probabilities is found correctly, such as exactly six plus exactly seven, and appropriate work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] The probability that exactly five seeds will sprout is determined appropriately.
or [1] The substitution for the sum of the three probabilities is indicated, but no further correct work is shown.
or [1] .7564 or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[94]

[4] 438, and appropriate work is shown, such as using the Law of Cosines or the Law of Sines.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Correct substitution is made into the Law of Cosines or the Law of Sines, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] 438, but no work is shown.
[0] Right triangle trigonometry is used inappropriately.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[95]

[4] 42, 138, 210, and 330, and appropriate work is shown, such as substituting for cos $2\theta$ and solving the resulting quadratic equation.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Incorrect substitution is made for cos $2\theta$, such as $1-\sin^2\theta$, but all further work is appropriate.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Correct substitution is made, and appropriate work is shown to obtain the values of sin $\theta$, but the values of $\theta$ are not found.
or [2] A quadratic equation in terms of sin $\theta$ is written in standard form, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] Correct substitution is made for cos $2\theta$, but no further correct work is shown.
or [1] 42, 138, 210, and 330, but no work is shown. [All four answers must be identified to receive this credit.]
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[96]

[4] .00046 or $\frac{46}{100{,}000}$ or an equivalent answer, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but the probability of hitting at most four home runs is found.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The probabilities of hitting exactly four and exactly five home runs are found, but the probabilities are not added.
[1] Appropriate work is shown, but the probability of hitting exactly four home runs is found.
or [1] Correct substitution into the Bernoulli equation for exactly four and exactly five home runs is made, but no further correct work is shown.
or [1] .00046 or $\frac{46}{100{,}000}$ or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[97]

[4] 1,500, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] A correct equation is written, but no further correct work is shown.
or [1] 1,500, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[98]

[4] 3.8, and the Law of Cosines is used.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but one computational error and one rounding error are made.
or [2] The Law of Cosines is shown, but sine is used instead of cosine, such as $x^2 = 3.2^2 + 5.6^2 - 2(3.2)(5.6)(\sin 40)$, but an appropriate answer is determined, based on that error.
[1] Substitution into the Law of Cosines is used, but no further work is shown.
or [1] 3.8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[99]

a [2] Appropriate sketches of the functions are shown, and the horizontal line tests are used to explain why the statement is true.
or [2] An explanation is given that the inverse of g is a function and the inverse of f is not a function, which includes a definition of the relationship between a function and its inverse or the vertical line test.
or [2] Appropriate sketches of the inverses are shown that use the vertical line test to explain why the statement is true.
or [2] The correct inverses are found algebraically, and appropriate explanations are given.
[1] An explanation is given that indicates only that g is a 1:1 function or that g passes the horizontal line test.
or [1] An explanation is given that indicates only that f is not a 1:1 function or that f does not pass the horizontal line test.
b [2] 3.2, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] 3.2, but no work is shown.
a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[100]

[4] –2 and –1, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but only one value of q is found.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as squaring only the left side of the equation.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] –2 and –1, but no work is shown.
[0] –2 or –1, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[101]

[4] 44, and appropriate work is shown, such as solving the equation $6{,}076 = 6{,}077 - 31\cos 2\theta$.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] An incorrect equation of equal difficulty is solved appropriately.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] 44, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[102]

[4] $\frac{-a}{2+a}$ or $\frac{a}{-2-a}$, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or simplification error is made.
[2] Appropriate work is shown, but two or more computational or simplification errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as not recognizing that -1 is a factor.
[1] Appropriate work is shown, but one conceptual error and one computational or simplification error are made.
or $\frac{-a}{2+a}$ or $\frac{a}{-2-a}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[103]

[4] (0,1) and (3,8), and both graphs are sketched correctly.
[3] Appropriate work is shown, but one graphing error is made, but all appropriate points of intersection are identified.
[2] Appropriate work is shown, but two or more graphing errors are made, but all appropriate points of intersection are identified.
or [2] Appropriate work is shown, but one conceptual error is made, such as failing to draw the graph over the specified interval, resulting in only one point of intersection.
or [2] Both graphs are sketched correctly, and the two points of intersection are indicated, but the coordinates are not stated or are stated incorrectly.
[1] Only the graph of the exponential function is sketched correctly, and no further correct work is shown.
or [1] (0,1) and (3,8), but no graph is sketched.
[0] (0,1) or (3,8), but no graph is sketched.
or [0] Only the line is graphed correctly.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[104]

[4] 11.8, and an appropriate application of the Law of Cosines is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] The Law of Cosines is correctly applied, but the square root is not found.
[2] The Law of Cosines is applied correctly, and correct substitutions are shown, but no further work is shown.
or [2] Appropriate work is shown, but more than one computational error is made.
[1] The diagram is set up with the correct sides and angles, and the Law of Cosines is written, but substitution is not made.
or [1] The diagram is set up with the correct sides and angles, but no further work is shown.
or [1] 11.8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[105]

[4] $\frac{513}{625}$ or 0.821 or an equivalent answer, and appropriate work is shown, such as ${}_4C_2(\frac{2}{5})^2(\frac{3}{5})^2+{}_4C_1(\frac{2}{5})^1(\frac{3}{5})^3+{}_4C_0(\frac{2}{5})^0(\frac{3}{5})^4$.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but a value for at least two, $\frac{328}{625}$, is found.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] An appropriate answer is found, but one conceptual error is made, such as multiplying the probabilities or using five as the number of spins.
or [2] Appropriate work is shown, but a value for less than two, $\frac{297}{625}$, is found.
[1] Appropriate work is shown, but a value for exactly two, $\frac{216}{625}$, is found.
or [1] $\frac{513}{625}$ or 0.821 or an equivalent answer, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[106]

[4] $\frac{-1}{m+1}$ or $\frac{1}{-m-1}$, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or simplification error is made.
[2] Appropriate work is shown, but two or more computational or simplification errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
[1] Appropriate work is shown, but one conceptual error and one computational or simplification error are made.
or [1] $\frac{-1}{m+1}$ or $\frac{1}{-m-1}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[107]

[4] 4.3-5.3, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] Appropriate work is shown, but the answer is not stated as an interval.
or [3] Appropriate work is shown, but the answer is expressed in inches.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] An appropriate inequality, such as $-3.25 \le \left|\frac{h-57.5}{2}\right| \le 3.25$, is written, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] Only half of the inequality is solved, but an appropriate answer is found and expressed to the nearest tenth of a foot.
or [1] 4.3-5.3, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[108]

[4] $y = 379.92(1.04)^x$ and 562, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] $y = 379.92(1.04)^x$ and 562, but the substitution is not shown to find the value of the stock.
or [3] The expression $379.92(1.04)^x$ is written and 562, and appropriate work is shown, but the equation is not written.
[2] Appropriate work is shown, but two or more computational or rounding errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The expression $379.92(1.04)^x$ is written and 562, but no work is shown.
or [2] A correct regression equation is written, but no further correct work is shown.
or [2] An incorrect exponential regression equation of equal difficulty is written, but an appropriate substitution is made, and an appropriate value of the stock is found.
[1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [1] An incorrect regression equation of a lesser degree of difficulty is written, but an appropriate substitution is made, and an appropriate value of the stock is found.
or [1] The expression $379.92(1.04)^x$ is written, but no further correct work is shown.
or [1] 562, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[109]

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[4] 41, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or rounding error is made.
[2] One incorrect formula is used, but an appropriate answer is found.
or [2] Appropriate work is shown, but one computational and one rounding error are made.
[1] 41, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[110]

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[4] 9 and 26, and appropriate work is shown, such as graphing and labeling the equations and identifying the points of intersection.
[3] Both functions are graphed correctly, and the points of intersection are indicated, but the prices are not stated.
or [3] The parabola is graphed correctly, but the line is graphed incorrectly, but appropriate prices are stated.
[2] The line and the parabola are graphed and labeled, but a conceptual error is made, such as only one price is found because the graph of the parabola is incomplete.
or [2] The line is graphed correctly, but the parabola is graphed incorrectly, but appropriate prices are stated.
or [2] 9 and 26, but only an algebraic solution is shown.
[1] Both the line and the parabola are graphed incorrectly, but appropriate prices are stated.
or [1] 9 and 26, but no work is shown.
[0] 9 or 26, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[111]

[4] 84, and appropriate work is shown, and correct explanations are written.
[3] Appropriate work is shown, but one computational or rounding error is made, but both explanations are correct.
or [3] 84, but only one of the explanations is correct.
[2] 84, but both explanations are only partially correct.
[1] 84, but both explanations are missing or are incorrect.
or [1] One correct explanation is written, but no further correct work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[112]

[4] The proof in column or paragraph form explains clearly, by using contradiction or indirect proof, that altitude $\overline{BD}$ does not bisect side $\overline{AC}$.
[3] An appropriate conclusion is shown, without specifying that congruent triangles are actually formed only if a triangle is isosceles.
[2] An appropriate diagram is drawn and some evidence that congruence may be an issue is shown, but no further reasoning is given or no conclusion is drawn.
[1] Circular reasoning is used or the statement is said to be true, but no proof by contradiction or indirect proof is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[113]

[4] $15 < x < 60$, and appropriate work is shown, such as solving the algebraic inequality $-10x^2 + 750x - 9000 > 0$ or a graphic solution.
[3] Appropriate work is shown, but one computational or graphing error is made.
[3] $15 \le x \le 60$, and appropriate work is shown.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as solving the equation $-10x^2 + 750x - 9000 > 0$ for 15 and 60.
or [2] An incorrect inequality of equal difficulty is solved appropriately.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [1] $15 < x < 60$, but no work is shown.
[0] $15 \le x \le 60$, and no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[114]

[6] $\frac{2}{1}$ or 2:1 or an equivalent ratio, and appropriate work is shown.
[5] Appropriate work is shown, but one computational error is made, but an appropriate ratio is found.
or [5] Appropriate work is shown, but the answer is not written as a ratio.
or [5] Appropriate work is shown, but the ratio is reversed or is simplified incorrectly.
[4] Appropriate work is shown, but two or more computational errors are made, but an appropriate ratio is found.
or [4] Correct measures are found for all the arcs and the angles, and appropriate work is shown, but no ratio is found.
or [4] Correct measures are found for all the arcs, but the measure of one angle is found incorrectly, but an appropriate ratio is found.
[3] One conceptual error is made, but appropriate work is shown, and an appropriate ratio is found.
or [3] Correct measures are found for all the arcs, but the measures of both angles are found incorrectly, but an appropriate ratio is found.
[2] Correct measures are found for all the arcs, but no further correct work is shown.
[1] Only the value of x is found correctly, and appropriate work is shown.
or [1] $\frac{2}{1}$ or 2:1 or an equivalent ratio, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[1]

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[6] 56.8 and 13, and appropriate work is shown, such as using the Law of Cosines and the Law of Sines.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
or [4] The Law of Cosines is used correctly to determine the magnitude of the resultant, but no further correct work is shown.
[3] Appropriate work is shown, but one conceptual error is made.
[2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [2] 56.8 and 13, but no work is shown.
[1] Appropriate work is shown to find the measure of the angle, but one computational or rounding error is made, and no further correct work is shown.
or [1] Correct substitutions are made into the Law of Cosines, but no further correct work is shown.
or [1] 56.8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[2]

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[6] 3.5, and appropriate work is shown.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] A substitution error is made, resulting in an incorrect quadratic equation of equal difficulty, but the incorrect equation is solved appropriately.
[3] A correct substitution is made, resulting in the correct quadratic equation in standard form, but the equation is not solved.
[2] A substitution error is made, resulting in an incorrect equation of equal difficulty, and one computational or rounding error is made.
[1] 3.5, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[3]

[6] Either a correct Euclidean proof is written, with a concluding statement that the diagonals bisect each other, or a correct analytic proof using coordinate geometry is written, with a concluding statement that the diagonals bisect each other.
[5] One reason is omitted or incorrect.
or [5] Appropriate work is shown, but one computational error is made.
[4] The appropriate triangles are proven to be congruent, but the corresponding parts and a final statement that indicates why the diagonals are bisected are omitted.
or [4] Appropriate work is shown, but two computational errors are made.
or [4] A correct analytic proof using coordinate geometry is written, but no concluding statement is made.
[3] An appropriate conclusion is drawn, including a statement that indicates why the diagonals are bisected; but only a partial proof is written, with two steps missing, and errors in the statements or reasons are made.
or [3] An analytic proof using coordinate geometry with more than two errors is written, but an appropriate concluding statement is made.
or [3] The diagram in an analytic proof is labeled incorrectly or numerically, but the rest of the proof is correct.
[2] Statements for the Euclidean proof are written, but no valid reasons are given.
or [2] A congruence proof is written with some valid statements and reasons, but a concluding statement that the diagonals bisect each other is not made.
[1] A correctly labeled diagram for a Euclidean proof is shown, but no proof is written.
or [1] An analytic proof using coordinate geometry with more than two errors is written, but no concluding statement is made.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[4]

[6] 30, 150, and 270, and appropriate work is shown.
[5] Appropriate work is shown, but one computational error is made.
[4] The correct equation is shown, but only two correct solutions are found.
[3] The correct equation is shown, but only one correct solution is found.
[2] The correct equation is solved for x, but no further work is shown.
[1] The correct equation is shown, but no further work is shown.
or [1] 30, 150, and 270, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[5]

[6] $-(x-3)$, $-x+3$, or $3-x$, and appropriate work is shown.
[5] Appropriate work is shown, but one computational, factoring, or simplification error is made.
[4] Appropriate work is shown, but two computational, factoring, or simplification errors are made.
or [4] $x-3$, and appropriate work is shown.
[3] Appropriate work is shown, but three or more computational, factoring, or simplification errors are made.
or [3] Appropriate work is shown, but one conceptual error is made, such as not multiplying by the multiplicative inverse.
[2] Appropriate work is shown, but one conceptual error and one computational, factoring, or simplification error are made.
[1] $-(x-3)$, $-x+3$, or $3-x$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[6]

[6] 312 and 30,642, and appropriate work is shown, such as using the Law of Cosines and the area formula.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
or [4] Appropriate work is shown, but one conceptual error is made.
or [4] Appropriate work is shown, but the square root is not computed to find the length of the third side, but an appropriate area is found.
or [4] The length of the third side is found correctly, but no further correct work is shown.
[3] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
[2] The area of the triangle is found correctly, but no further correct work is shown.
or [2] 312 and 30,642, but no work is shown.
[1] Appropriate work is shown to find the area of the triangle, but one computational or rounding error is made, and no further correct work is shown.
or [1] 312 or 30,642, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[7]

[6] A complete and correct proof that includes a concluding statement is written, such as showing that $\overline{AB}$ is parallel to $\overline{CD}$ and that $\overline{BC}$ is not parallel to $\overline{AD}$ by finding their slopes and using the distance formula to show that the two nonparallel sides are equal.
[5] Appropriate work is shown, but one computational error is made.
[4] Appropriate work is shown, but two or more computational errors are made.
or [4] Appropriate work is shown, but one conceptual error is made, such as using an incorrect formula.
or [4] The slopes of all four sides are found correctly and the lengths of $\overline{AD}$ and $\overline{BC}$ are found correctly, and appropriate work is shown, but no conclusion is stated.
or [4] A proof is written that correctly shows *ABCD* is a trapezoid, but it is not proved to be isosceles.
[3] The slopes of only one pair of sides are found correctly, but the lengths of $\overline{AD}$ and $\overline{BC}$ are found correctly, and appropriate work is shown, and an appropriate conclusion is stated.
or [3] A correct numerical illustration is given in lieu of a proof of the general case.
[2] The slopes of only one pair of sides are found correctly, but the lengths of $\overline{AD}$ and $\overline{BC}$ are found correctly, and appropriate work is shown, but no conclusion is stated.
[1] Either the slopes or the lengths of $\overline{AD}$ and $\overline{BC}$ are found correctly, but no conclusion is stated.
or [1] The correct definition of an isosceles trapezoid is written, but no further correct work is shown.
[0] The slopes of $\overline{AB}$ and $\overline{DC}$ are found correctly, but no further correct work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[8]

[6] The vertices $A'(-1,1)$, $B'(4,-2)$, $C'(3,-5)$, and $D'(-2,-2)$ are stated and a complete and correct proof that includes a conclusion is written.
[5] The vertices are stated, and a proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one reason is missing or is incorrect.
or [5] A complete proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but the vertices of $A'B'C'D'$ are not stated.
[4] The vertices are stated, and a proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.
[3] The vertices are stated, and a proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two reasons are missing or are incorrect.
[2] The vertices are stated, and some correct relevant statements about the proof are made, but three or four statements or reasons are missing or are incorrect.
[1] The vertices $A'(-1,1)$, $B'(4,-2)$, $C'(3,-5)$, and $D'(-2,-2)$ are stated, but no proof is written.
[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[9] obviously incorrect procedure.

[6] 120 and 4.2, and appropriate work is shown, such as substituting $t = 0$ into the equation and solving the equation $-5t^2 - 8t + 120 = 0$.
[5] Appropriate work is shown, but one computational or rounding error is made.
or [5] 120 and 4.2, but no work is shown to find the amount of water, but appropriate work is shown to find the amount of time.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
or [4] Appropriate work is shown, and the amount of water is found correctly, but one conceptual error is made in finding the amount of time.
or [4] The amount of time is found correctly, and appropriate work is shown, but the amount of water is not found.
or [4] The amount of water is found correctly, and appropriate work is shown, and a correct substitution into the quadratic formula is made, but the amount of time is not found.
[3] Appropriate work is shown, but one conceptual error is made in finding the amount of time, and one computational error is made in finding the amount of water.
[2] The amount of water is found correctly, and appropriate work is shown, but no further correct work is shown.
or [2] 120 and 4.2, but no work is shown.
[1] 120 *or* 4.2, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[10] incorrect procedure.

[6] A correct scatter plot, $y = 0.62x + 29.18$, $r = 0.92$, and 83; and appropriate work is shown.
[5] Appropriate work is shown, but one computational or rounding error is made.
or [5] A correct scatter plot, equation, and score are shown, but no *r*-value is found.
[4] A correct scatter plot and equation are shown, but the *r*-value and score are missing or incorrect.
or [4] An incorrect equation is shown, but all further work is appropriate.
or [4] The scatter plot is missing or incorrect, but all further work is appropriate.
[3] The scatter plot is incorrect, but a correct equation and either a correct *r*-value or score are found.
or [3] The scatter plot is correct, but an incorrect equation and either an appropriate *r*-value or score based on the incorrect equation are found.
[2] Only a correct scatter plot is shown, and all further work is missing or incorrect.
or [2] Only a correct equation is shown, and all further work is missing or incorrect.
[1] An incorrect equation is shown, but an appropriate score is found.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[11]

[6] A correct diagram is drawn and 134, and appropriate work is shown.
[5] Appropriate work is shown, but one computational or rounding error is made.
or [5] 134, and appropriate work is shown, but the diagram is not drawn or is drawn incorrectly.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
or [4] A correct diagram is drawn and one correct equation using the Law of Sines is solved appropriately, but no further correct work is shown.
[3] Appropriate work is shown, but one conceptual error is made.
or [3] An incorrect diagram is drawn, but an appropriate solution with an equal degree of difficulty is provided.
or [3] A correct diagram is drawn and correct equations are written, but no further correct work is shown.
[2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [2] A correct diagram is drawn, but only one correct trigonometric equation is written, and no further correct work is shown.
[1] A correct diagram is drawn, but no further correct work is shown.
or [1] An incorrect diagram is drawn, but one correct trigonometric equation is solved appropriately.
or [1] 134, but no work is shown and no diagram is drawn.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[12]

[6] A complete and correct proof is written.
[5] A proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one statement and/or reason is missing or is incorrect.
[4] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two statements and/or reasons are missing or are incorrect.
[3] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.
[2] Some correct relevant statements about the proof are made, but three or four statements and/or reasons are missing or are incorrect.
[1] Only one correct statement and reason are written.
[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[13]

[6] 330, and appropriate work is shown, such as solving $\frac{\sin 13}{250} = \frac{\sin 37}{y}$ and calculating $\cos 50 = \frac{x}{668.8288536}$ and subtracting 100.
[5] Appropriate work is shown, but one computational or rounding error is made.
or [5] Appropriate work is shown, but 100 is not subtracted from the answer.
or [5] An incorrect trigonometric function is used, but the rest of the work is appropriate.
[4] The Law of Sines is used incorrectly, such as using the wrong angle measure, but an appropriate distance from the rocks is found.
[3] The Law of Sines is used correctly, but no answer or an incorrect answer is found.
[2] The Law of Sines is used without finding the angles correctly, and no answer or an incorrect answer is found.
[1] Only a correct diagram is drawn.
or [1] 330, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[14]

[6] $\overline{KA} \parallel \overline{ET}$, $\overline{AT}$ not $\parallel \overline{KE}$, and $\overline{KE} \neq \overline{AT}$, and appropriate work is shown.
[5] Appropriate work is shown, but one computational error leads to incorrect conclusions that are appropriate, based on that error.
[4] Appropriate work is shown to find $\overline{KA} \parallel \overline{ET}$ or $\overline{AT}$ not $\parallel \overline{KE}$ and $\overline{KE} \neq \overline{AT}$, but no further correct work is shown.
[3] Appropriate work is shown to find $\overline{KE} \neq \overline{AT}$, and at least three of the four slopes are found correctly, but no statement regarding parallelism is made.
or [3] Appropriate work is shown to find the four slopes, and correct statements of parallelism are made, but no further correct work is shown.
[2] Appropriate work is shown to find unequal sides, but no further correct work is shown.
or [2] Appropriate work is shown to find the four slopes, but no conclusion is drawn.
or [2] The four slopes are correct, but no work is shown, but appropriate opposite sides are stated to be parallel and nonparallel.
or [2] The slope and distance formulas are used, but more than one computational error is made, but one accurate conclusion is drawn.
[1] Only two correct slopes or distances are found.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[15]

[6] 16.2, and appropriate work is shown, such as using the Law of Cosines to find one angle, and then using $K = \frac{1}{2}ab\sin C$ or Hero(n)'s formula, $A = \sqrt{s(s-a)(s-b)(s-c)}$, to find the area.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
[3] Appropriate work is shown, but one conceptual error is made, but an appropriate area is found.
or [3] The Law of Cosines is used to find a correct measure for one of the angles of the triangle, but no further correct work is shown.
[2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
[1] Correct substitution is made into the Law of Cosines, but no further correct work is shown.
or [1] 16.2, but no work is shown.
[0] Right triangle trigonometry is used inappropriately.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[16]

[6] A complete and correct proof is written.
[5] A proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one statement or reason is missing or is incorrect, or the concluding statement is missing.
[4] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two statements or reasons are missing or are incorrect.
[3] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.
[2] Some correct relevant statements about the proof are made, but three or four statements or reasons are missing or are incorrect.
[1] Only one correct statement and reason are written.
[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[17]

[6] $m\angle ACB = 36$ and $DOE = 39$, and appropriate work is shown. [If trigonometry is used to find that $m\angle ACB = 35.98138002$, allow full credit for the full display of the calculator or any correctly rounded response.]
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
[3] Appropriate work is shown, but one conceptual error is made.
or [3] $m\angle ACB = 36$, and appropriate work is shown, but no further correct work is shown.
or [3] $DOE = 39$, and appropriate work is shown, but no further correct work is shown.
[2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [2] $m\angle ACB = 36$ and $DOE = 39$, but no work is shown.
[1] The measures of the arcs are found correctly, but no further correct work is shown.
or [1] $m\angle ACB = 36$ or $DOE = 39$, but no work is shown.
[0] 36 and 39, but no work is shown and the answers are not labeled.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[18]

[6] $y = 0.01021x - 1.66787$, 4.56, and 913, and appropriate work is shown.
[5] Appropriate work is shown, but one computational or rounding error is made.
or [5] The expression $0.01021x - 1.66787$ is written and 4.56 and 913 are found, and appropriate work is shown.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
or [4] A correct equation is written, but either the gross earnings or the number of theaters is not found, but appropriate work is shown.
or [4] An incorrect equation of equal difficulty is written, but appropriate answers are found, and appropriate work is shown.
[3] Appropriate work is shown, but one conceptual error is made.
or [3] $y = 0.01021x - 1.66787$, 4.56, and 913, but no work is shown.
or [3] The expression $0.01021x - 1.66787$ is written and either 4.56 or 913 is found, and appropriate work is shown.
[2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [2] A correct equation is written, but no further correct work is shown.
[1] 4.56 and 913, but no work is shown.
or [1] The expression $0.01021x - 1.66787$ is written, but no further correct work is shown.
[0] Either 4.56 or 913, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[19]

[6] $m\overset{\frown}{GF} = 30$, $m\angle BHD = 65$, $m\angle BDG = 75$, $m\angle GDE = 55$, $m\angle C = 35$, and $m\angle BOD = 100$, and appropriate work is shown.
[5] $m\overset{\frown}{GF}$ is determined correctly, but $m\overset{\frown}{BD}$ is determined incorrectly, but all five of the angle measures are determined appropriately.
or [5] $m\overset{\frown}{GF}$ is determined incorrectly, but all five of the angle measures are determined appropriately, based on the incorrect arc measure.
or [5] $m\overset{\frown}{GF}$ is determined correctly, but only four of the angle measures are determined correctly.
[4] $m\overset{\frown}{GF}$ is determined incorrectly, and only four of the angle measures are determined appropriately, based on the incorrect arc measure.
or [4] $m\overset{\frown}{GF}$ is determined correctly, but only three of the angle measures are determined correctly.
[3] $m\overset{\frown}{GF}$ is determined incorrectly, and only three of the angle measures are determined appropriately, based on the incorrect arc measure.
or [3] $m\overset{\frown}{GF}$ is determined correctly, but only two of the angle measures are determined correctly.
[2] $m\overset{\frown}{GF}$ is determined incorrectly, and only two of the angle measures are determined appropriately, based on the incorrect arc measure.
or [2] $m\overset{\frown}{GF}$ is determined correctly, but only one angle measure is determined correctly.
[1] rnGF is determined incorrectly, and only one angle measure is determined appropriately.
or [1] $m\overset{\frown}{GF}$ is determined correctly, but no further correct work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[20]

[21]
[6] 8, and appropriate work is shown, such as a correctly labeled graph, a table of values, or an algebraic solution.
[5] Appropriate work is shown, but one computational or graphing error is made.
[4] Appropriate work is shown, but two or more computational or graphing errors are made.
or [4] Appropriate work is shown, and the correct values of t where the height of the tide is 7 are identified (2 and 10), but the correct number of hours is not stated.
[3] Appropriate work is shown, but one conceptual error is made.
or [3] A correct table or graph is constructed, but no further correct work is shown.
[2] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [2] The correct values of t (2 and 10) and 8 are written, but no work is shown.
[1] 8, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[22]
[6] 561.3 and 43.3, and appropriate work is shown, such as using the Law of Cosines and the Law of Sines.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
or [4] The resultant speed is found correctly, but no further correct work is shown.
[3] Appropriate work is shown, but one conceptual error is made.
[2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
[1] Correct substitutions are made into the Law of Cosines, but no further correct work is shown.
or [1] 561.3 and 43.3, but no work is shown.
[0] 561.3 or 43.3, but no work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[6] An appropriate scatter plot is drawn, and either $y = 276.67(1.21)^x$ and \$15,151,000 or $y = 276673.91(1.21)^x$ and \$15,152,000.
[5] Appropriate work is shown, but one computational error is made.
or [5] Appropriate work is shown, but one error is made in rounding the coefficients or by substituting an incorrect value of x for the year 2005.
or [5] Appropriate work is shown, but an incorrect nonlinear function for the regression equation is written, but an appropriate salary is found.
or [5] No scatter plot or an incorrect scatter plot is drawn, but the correct regression equation is written, and the correct salary is found.
[4] Appropriate work is shown, but two or more computational errors are made.
or [4] No scatter plot or an incorrect scatter plot is drawn, and one rounding error is made, but the correct regression equation is written, and an appropriate salary is found.
[3] Appropriate work is shown, but a linear function for the regression equation is written, but an appropriate salary is found.
or [3] An appropriate scatter plot is drawn, and the correct regression equation is written, but no further correct work is shown.
[2] An appropriate scatter plot is drawn, and the correct salary is found, but no work or regression equation is shown.
or [2] An appropriate scatter plot is drawn, but an incorrect regression equation is written, but an appropriate salary is found.
[1] No scatter plot or an incorrect scatter plot is drawn, and an incorrect regression equation is written, but an appropriate salary is found.
[1] An appropriate scatter plot is drawn, but no further correct work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[23]

[6] $p = 8.1875t + 72.7860$, 1993, and 220.2, and appropriate work is shown.
[5] Appropriate work is shown, but one computational or rounding error is made.
or [5] The expression $8.1875t + 72.7860$ is written and 1993 and 220.2 are found, and appropriate work is shown.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
or [4] A correct equation is written, but either the year or the predicted value for 2008 is not found, but appropriate work is shown.
or [4] An incorrect equation is solved appropriately.
[3] Appropriate work is shown, but one conceptual error is made.
or [3] $p = 8.1875t + 72.7860$, 1993, and 220.2, but no work is shown.
or [3] The expression $8.1875t + 72.7860$ is written and either 1993 or 220.2 is found, and appropriate work is shown.
[2] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
or [2] A correct equation is written, but no further correct work is shown.
or [2] 1993 and 220.2, but no work is shown.
[1] The expression $8.1875t + 72.7860$ is written, but no further correct work is shown.
or [1] 1993 or 220.2, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[24]

[6] $-\frac{8}{3}$, and appropriate work is shown.
[5] Appropriate work is shown, but one computational error is made.
[4] Appropriate work is shown, but two or more computational errors are made.
[3] Appropriate work is shown, but one conceptual error is made, such as not factoring out –1 when canceling out 2 – x.
[2] Appropriate work is shown, but one conceptual error and one computational error are made.
[1] $-\frac{8}{3}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[25]

a [2] Both circles are drawn and labeled correctly.
[1] Both circles are drawn, but one conceptual error is made.
or [1] Only one circle is drawn and labeled correctly.
b [4] 0.7722345326 or an equivalent decimal answer, and appropriate work is shown, such as $\frac{400-29\pi}{400}$.
[3] Appropriate work is shown, but one computational or rounding error is made.
or [3] The probability that point (x,y) lies inside the circles is found, and appropriate work is shown.
[2] Appropriate work is shown, but more than one computational or rounding error is made.
or [2] Only the correct areas of the square and the circles are found.
[1] Only the correct area of the square or the circles is found.
or [1] 0.7722345326 or an equivalent answer, but no work is shown.
a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[26]

[6] The correct slopes of $AB = \frac{1}{2}$ and $CD = \frac{1}{2}$ are found, $\overline{AB} \parallel \overline{CD}$ is stated, and an explanation of why they are parallel is given. The correct slopes of $AD = -\frac{5}{2}$ and $BC = -\frac{1}{2}$ are found, $\overline{AD}$ is not parallel to $\overline{BC}$ is stated, and an explanation of why they are not parallel is given. An explanation that *ABCD* is a trapezoid is given.
[5] The correct slopes of $\overline{AB}$, $\overline{CD}$, $\overline{AD}$, and $\overline{BC}$ are found, and $\overline{AB} \parallel \overline{CD}$ and $\overline{AD}$ not $\parallel \overline{BC}$ are stated, but an explanation that *ABCD* is a trapezoid is not given.
or [5] One computational error is made in finding the slopes, but all further work is appropriate, based on the calculated slopes.
[4] The correct slope of $\overline{AB}$ and $\overline{CD}$ are found, and $\overline{AB} \parallel \overline{CD}$ is stated, but incorrect slopes of $\overline{AD}$ and $\overline{BC}$ are found, but an explanation of why they are not parallel is given, but an explanation that *ABCD* is a trapezoid is not given.
or [4] More than one computational error is made in finding the slopes, but $\overline{AB}$ and $\overline{CD}$ are found to have equal slopes and $\overline{AD}$ and $\overline{BC}$ to have different slopes, but an explanation that *ABCD* is a trapezoid is given.
[3] Incorrect slopes of $\overline{AB}$, $\overline{CD}$, $\overline{AD}$, and $\overline{BC}$ are found, such as by using an incorrect formula, $\overline{AB}$ and $\overline{CD}$ are found to have equal slopes and $\overline{AD}$ and $\overline{BC}$ to have different slopes, but an explanation that *ABCD* is a trapezoid is given.
[2] Only the correct slopes of $\overline{AB}$, $\overline{CD}$, $\overline{AD}$, and $\overline{BC}$ are found, and appropriate work is shown.
[1] Only two correct slopes are found, and appropriate work is shown.

[27]

or [1] $AB = \frac{1}{2}$, $CD = \frac{1}{2}$, $AD = -\frac{5}{2}$, and $BC = -\frac{1}{2}$, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[28]

[6] 80 and 9.2, and appropriate work is shown.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
or [4] Appropriate work is shown, but one conceptual error is made in solving for one of the values.
or [4] 80, and appropriate work is shown, but the length of $\overline{PT}$ is not found or is found incorrectly.
or [4] The measure of all three arcs and the length of $\overline{PT}$ are found correctly, but the measure of $\angle P$ is not found or is found incorrectly.
[3] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
[2] Appropriate work is shown, but one conceptual error is made in solving for each value.
or [2] 80 and 9.2, but no work is shown.
or [2] 9.2, and appropriate work is shown, but no further correct work is shown.
or [2] The measures of all three arcs are found correctly, but no further correct work is shown.
[1] 80 or 9.2, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[29]

[6] $y = -6.2x + 12{,}451.2$; 20.2 thousand; and 2008; and appropriate work is shown.
[5] The correct equation is shown, but only the number of gallons or the year is correct.
[4] The slope and $y$-intercept are incorrect, but the slope is negative and the number of gallons and the year are appropriate, based on the incorrect equation.
[3] The slope and $y$-intercept are incorrect, but the slope is negative, but only the number of gallons or the year is appropriate, based on the incorrect equation.
[2] The correct equation is shown, but the number of gallons and the year are not determined or are determined incorrectly.
or [2] The incorrect equation $y = 6.2x + 12{,}451.2$ is shown, but appropriate work is shown for the number of gallons and the year.
[1] An incorrect equation is shown with a negative slope, and the number of gallons and the year are not determined.
or [1] 20.2 thousand and 2008, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[6] A complete and correct proof is shown.
[5] Appropriate work is shown, but one computational error is made.
or [5] Appropriate work is shown, but the final conclusion is not justified or is justified incorrectly.
[4] Appropriate work is shown, but two or more computational errors are made.
or [4] Appropriate work is shown to prove TEAM is a parallelogram and not a square, but no work is shown to prove it is a rhombus.
or [4] Appropriate work is shown to prove TEAM is a rhombus, and partial work is shown to prove TEAM is not a square, but the conclusion is not adequately justified.
[3] Appropriate work is shown to prove TEAM is a rhombus, but no further correct work is shown.
or [3] Appropriate work is shown to prove TEAM is not a square, but an incorrect method is used to prove TEAM is a rhombus.
or [3] An accurate explanation of the process required to complete the proof is stated, and needed formulas are given, but no further correct work is shown.
[2] Appropriate work is shown to prove TEAM is a parallelogram, but no further correct work is shown.
[1] A complete explanation of the method of the proof is written, but no further correct work is shown.
or [1] A statement that TEAM is not a square and a correct reason are written, but no further correct work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[30]

[6] Appropriate work is shown, such as using slopes to prove *ABCD* is a parallelogram but not a rectangle, and an appropriate concluding statement is made.
[5] Appropriate work is shown, but one computational or graphing error is made.
[4] Appropriate work is shown, but two or more computational or graphing errors are made.
or [4] Appropriate work is shown, but one conceptual error is made, such as using an incorrect formula.
or [4] A proof is written that correctly shows either *ABCD* is a parallelogram or it is not a rectangle, but not both.
[3] Appropriate work is shown, but two or more computational or graphing errors are made, and the concluding statement is incomplete.
[2] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [2] All four slopes are found correctly or the lengths of all four sides are found correctly, and appropriate work is shown, but no further correct work is shown.
[1] The slopes of all four sides are identified or the lengths of all four lines are identified, but no work is shown and no proof is written.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[31]

[6] A correct scatter plot, $y = (0.002)(1.070)^x$, and \$1.52 or an equivalent answer, and appropriate work is shown.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] A correct scatter plot is shown, but an incorrect equation of equal difficulty is used, but an appropriate fare for 1998 is determined, based on the incorrect equation.
or [4] A correct scatter plot with a function other than exponential is used, but an appropriate equation and fare derived from that equation are shown.
[3] A correct scatter plot is shown, and an appropriate fare based on the scatter plot is found, but no equation or work is shown.
[2] Only a correct scatter plot is shown.
[1] \$1.52, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[32]

[6] $\overline{JK} \parallel \overline{ML}, \overline{MJ}$ not $\parallel \overline{KL}$, $\overline{MJ} \neq \overline{KL}$, and appropriate work is shown or a complete and correct proof is written, and a concluding statement is written.
[5] Appropriate work is shown and a correct concluding statement is written, but one computational error is made in determining the slopes or the lengths of the legs.
or [5] Appropriate work is shown, but the concluding statement is missing or is incomplete.
[4] Appropriate work is shown and a correct concluding statement is written, but two or more computational errors are made.
or [4] The quadrilateral is proved to be a trapezoid, but the two nonparallel sides are not proved to be unequal.
or [4] A proof is written that shows that $\overline{JK} \parallel \overline{ML}$ and $\overline{MJ} \neq \overline{KL}$, but the difference between a quadrilateral and a trapezoid is not addressed.
[3] Appropriate work is shown, but one conceptual error is made.
[2] The quadrilateral is proved to be a trapezoid, but one conceptual error is made, and the two nonparallel sides are not proved to be unequal.
or [2] The lengths of all four sides are found correctly, but no further correct work is shown.
or [2] The two nonparallel sides are proved to be unequal, but no further correct work is shown.
[1] The proof shows that the first set of sides is parallel, but no further correct work is shown.
or [1] JKLM is graphed correctly and the definition of an isosceles trapezoid is written, but no proof is written.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[33]

[6] $\overline{W} = 44.6$ and $\overline{L} = 43.2$, the line of best-fit equation ($y = -1.007559x + 88.137149$) is shown, and an appropriate justification of point $(\overline{W}, \overline{L})$ fitting or not fitting, depending on the rounding of the equation, is given.
[5] $\overline{W}$ or $\overline{L}$ is incorrect, but the rest of the work is appropriate.
or [5] All conditions of the problem are met, except it is not stated whether $(\overline{W}, \overline{L})$ lies or does not lie on the line of best fit.
or [5] $\overline{W}$ and $\overline{L}$ and the equation of the line of best fit are correct, but one error results in an incorrect conclusion, such as the calculation or interchanging of $\overline{W}$ and $\overline{L}$.
[4] Both $\overline{W}$ and $\overline{L}$ are incorrect, but the rest of the work is appropriate.
or [4] $\overline{W}$ and $\overline{L}$ are correct, but the equation of the line of best fit is incorrect, but the justification is appropriate, based on the incorrect equation.
or [4] $\overline{W}$ and $\overline{L}$ are correct, a correct scatter plot is drawn, a correct line of best fit is drawn, $(\overline{W}, \overline{L})$ is plotted correctly, and a statement indicating that the point does or does not fit the line is given, with an appropriate explanation, but no equation is used.
or [4] All conditions of the problem are met, except for the justification of whether $(\overline{W}, \overline{L})$ lies on the line.
[3] $\overline{W}$ and $\overline{L}$ are correct, but the equation of the line of best fit is stated incorrectly, and no further work is shown.
[2] Only $\overline{W}$ and $\overline{L}$ are found correctly.
[1] Only one mean is found correctly.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[34]

[6] 2,700, and appropriate work is shown, such as using the Law of Cosines and finding the area of the triangle.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but more than one computational or rounding error is made.
or [4] Appropriate work is shown, and the area of the triangle is determined correctly, but the dollar amount is not determined or is determined incorrectly.
or [4] The Law of Cosines is used correctly to determine an angle, but an incorrect procedure is used to find the area, but an appropriate dollar amount is found.
or [4] The Law of Cosines is used incorrectly to determine an angle, but a correct procedure is used to find the area, and an appropriate dollar amount is found.
[3] The Law of Cosines is used correctly to determine an angle, but an incorrect procedure is used to find the area, and the dollar amount is not determined or is determined incorrectly.
[2] The Law of Cosines is used correctly to determine an angle, but no further correct work is shown.
[1] A correct equation using the Law of Cosines is written, but no further correct work is shown.
or [1] 2,700, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[35]

[6] 19, and appropriate work is shown, such as $P(\text{at least three}) = {}_4C_3(0.6)^3(0.4)+{}_4C_4(0.6)^4$ and $P(0) = (0.4)^4$.
[5] Appropriate work is shown, but one computational error is made.
or [5] Correct probabilities are computed, but no answer or an incorrect answer is found.
[4] Appropriate work is shown, but two or more computational errors are made.
or [4] Only the probability for at least three strikes is found correctly, but an appropriate ratio is determined.
[3] The probability for at least three strikes is found correctly, and no further correct work is shown.
or [3] Only the probability for zero strikes is found correctly, but an appropriate ratio is determined.
[2] Only the probability for zero strikes is found correctly, and no further correct work is shown.
or [2] Only the equation for the probability for at least three strikes is written, and it is not solved.
[1] Conceptual errors are made in finding the probabilities, but an appropriate ratio is determined, based on the incorrect probabilities.
or [1] 19, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[36]

[6] 6,246 and a correct diagram is drawn, and appropriate work is shown, such as the use of the Law of Sines twice or the Law of Sines followed by right triangle trigonometry or another valid method.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] One of the two unknown sides of the triangle is calculated correctly and appropriate work is shown, but an incorrect method is used for calculating the altitude.
[3] A correct diagram is drawn, and the Law of Sines is used, but one computational or rounding error is made, and the altitude is not found.
[2] 6,246 and a correct diagram is drawn, but no further work is shown.
or [2] A correct diagram is drawn, but the assumption is made that the altitude bisects the base, and an appropriate altitude is found.
[1] Only a correct diagram is drawn, and no further correct work is shown.
or [1] 6,246, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[37]

[6] A complete and correct proof is shown, such as the example below:

| Statements | Reasons |
|---|---|
| 1 Chords $\overline{AB}$ and $\overline{CD}$ of circle $O$ intersect at $E$, and chords $\overline{AB}$ and $\overline{CD}$ are drawn. | 1 Given |
| 2 $\angle A \cong \angle C$ | 2 Inscribed angles of a circle that intercept the same arc are congruent. |
| 3 $\angle AED \cong \angle CEB$ | 3 Vertical angles are congruent. |
| 4 $\triangle AED \sim \triangle CEB$ | 4 AA $\cong$ AA |
| 5 $\frac{AE}{CE} = \frac{ED}{EB}$ | 5 Corresponding sides of similar triangles are in proportion. |
| 6 $(AE)(EB) = (CE)(ED)$ | 6 In a proportion, the product of the means equals the product of the extremes. |

[5] $\Delta AED$ and $\Delta CEB$ are correctly proved to be similar, and the appropriate proportion is written with justification.
or [5] A correct proof is shown, but one of the justifications is missing or is incorrect.
[4] $\Delta AED$ and $\Delta CEB$ are correctly proved to be similar, but no further work is shown.
[3] A correct proof is shown, but more than one justification is missing or is incorrect.
[2] The triangles are said to be similar, and the conclusion is written.
[1] Only one correct statement and justification are given.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[38]