1. 080601b, P.I. A2.N.1

The expression $4^{\frac{1}{2}} \cdot 2^3$ is equal to

[A] $8^{\frac{3}{2}}$ [B] 4 [C] 16 [D] $4^{\frac{3}{2}}$

2. 080602b, P.I. A2.A.22

What is the solution of the equation $\sqrt{2x-3}-3=6$?

[A] 39 [B] 6 [C] 42 [D] 3

3. 080603b, P.I. A.A.41

What is the minimum point of the graph of the equation $y=2x^2+8x+9$?

[A] (2,33) [B] (-2,-15)

[C] (-2,1) [D] (2,17)

4. 080604b, P.I. A2.A.67

If x is a positive acute angle and $\cos x=\frac{\sqrt{3}}{4}$, what is the exact value of $\sin x$?

[A] $\frac{\sqrt{3}}{5}$ [B] $\frac{4}{5}$ [C] $\frac{3}{5}$ [D] $\frac{\sqrt{13}}{4}$

5. 080605b, P.I. A2.A.38

Which equation does *not* represent a function?

[A] $y=|x|$ [B] $y=4$

[C] $y=x^2+5x$ [D] $x=\pi$

6. 080606b, P.I. A2.N.5

The expression $\frac{12}{3+\sqrt{3}}$ is equivalent to

[A] $6-2\sqrt{3}$ [B] $12-\sqrt{3}$

[C] $4-2\sqrt{3}$ [D] $2+\sqrt{3}$

7. 080607b, P.I. A2.A.19

The function $y=2^x$ is equivalent to

[A] $y=\log_2 x$ [B] $x=\log_2 y$

[C] $y=x\log 2$ [D] $x=y\log 2$

8. 080608b

In ΔABC, D is a point on $\overline{AC}$ such that $\overline{BD}$ is a median. Which statement must be true?

[A] $\overline{BD}\perp\overline{AC}$ [B] $\Delta ABD\cong\Delta CBD$

[C] $\overline{AD}\cong\overline{CD}$ [D] $\angle ABD\cong\angle CBD$

9. 080609b

A designer who is planning to install an elliptical mirror is laying out the design on a coordinate grid. Which equation could represent the elliptical mirror?

[A] $x^2+4y^2=144$ [B] $x^2=144+36y^2$

[C] $x^2+y^2=144$ [D] $y=4y^2+144$

10. 080610b, P.I. A2.A.68

A solution set of the equation $5\sin\theta+3=3$ contains all multiples of

[A] 90° [B] 135° [C] 180° [D] 45°

11. 080611b

What is the total number of points of intersection for the graphs of the equations $y=x^2$ and $y=-x^2$?

[A] 2 [B] 0 [C] 1 [D] 3

12. 080612b, P.I. A.A.8

For which equation is the sum of the roots equal to the product of the roots?

[A] $x^2+3x-6=0$ [B] $x^2-8x-4=0$

[C] $x^2-4x+4=0$ [D] $x^2+x+1=0$

13. 080613b

If the perimeter of an equilateral triangle is 18, the length of the altitude of this triangle is

[A] $6\sqrt{3}$ [B] 3 [C] $3\sqrt{3}$ [D] 6

14. 080614b, P.I. A2.N.10

Jonathan's teacher required him to express the sum $\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}+\frac{6}{7}$ using sigma notation. Jonathan proposed four possible answers. Which of these four answers is *not* correct?

[A] $\sum_{k=3}^{7}\frac{k-1}{k}$ [B] $\sum_{k=1}^{5}\frac{k}{k+1}$

[C] $\sum_{k=2}^{6}\frac{k}{k+1}$ [D] $\sum_{k=1}^{5}\frac{k+1}{k+2}$

15. 080615b, P.I. A2.A.69

What is the period of the graph of the equation $y=2\sin\frac{1}{3}x$?

[A] $\frac{3\pi}{2}$ [B] $\frac{2}{3}\pi$ [C] 2π [D] 6π

16. 080616b

What is the solution set of the equation $|x^2-2x|=3x-6$?

[A] {2,3} [B] {2}

[C] {±3} [D] {2,±3}

17. 080617b, P.I. A2.A.77

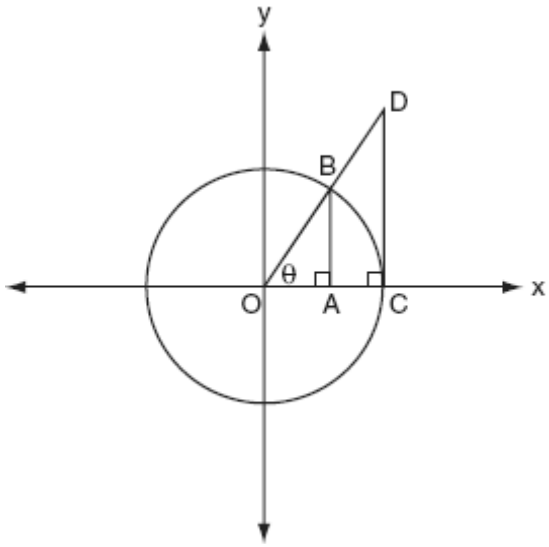
The expression $\frac{\sin 2\theta}{\sin^2\theta}$ is equivalent to

[A] $2\cot\theta$ [B] $\frac{2}{\sin\theta}$

[C] $2\tan\theta$ [D] $2\cos\theta$

18. 080618b

The accompanying diagram shows unit circle *O*, with radius $OB=1$.



Which line segment has a length equivalent to $\cos\theta$?

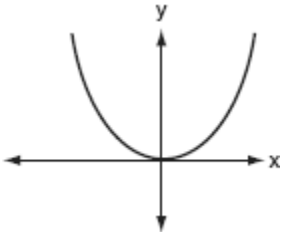
[A] $\overline{OC}$ [B] $\overline{OA}$ [C] $\overline{AB}$ [D] $\overline{CD}$

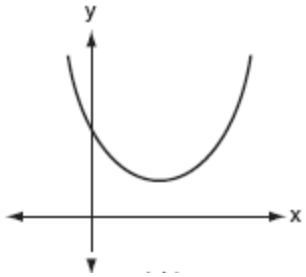
19. 080619b, P.I. A.A.16

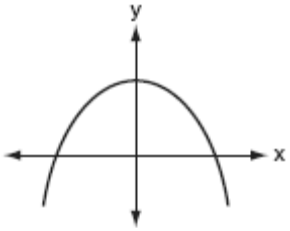
The expression $\frac{3y^2-12y}{4y^2-y^3}$ is equivalent to

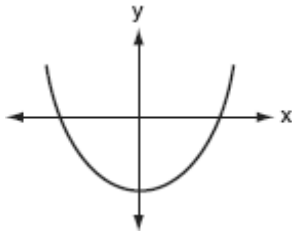
[A] $\frac{3}{4}-\frac{12}{y^2}$ [B] $-\frac{3}{y}$ [C] $\frac{3}{y}$ [D] $-\frac{9}{4}$

20. 080620b
Which graph represents a quadratic function with a negative discriminant?

[A] 

[B] 

[C] 

[D] 

21. 080621b, P.I. A2.N.9
The complex number $c+di$ is equal to $(2+i)^2$. What is the value of c?

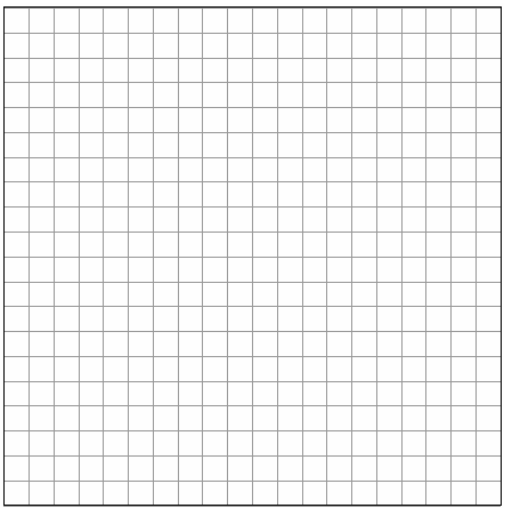
22. 080622b, P.I. A.A.23
The volume of any spherical balloon can be found by using the formula $V=\frac{4}{3}\pi r^3$. Write an equation for r in terms of V and π.

23. 080623b, P.I. A2.M.2
What is the number of degrees in an angle whose radian measure is $\frac{7\pi}{12}$?

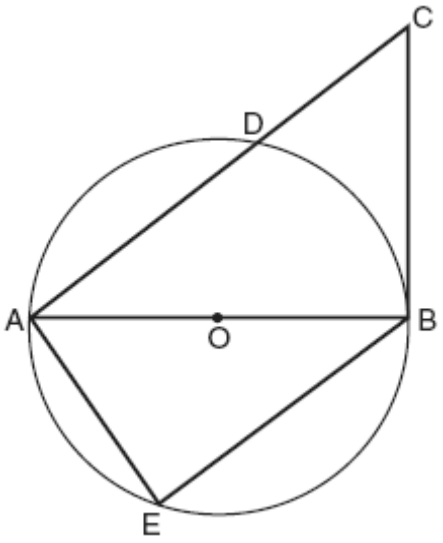
24. 080624b, P.I. A2.A.28
Solve for x: $\log_b 36 - \log_b 2 = \log_b x$

25. 080625b, P.I. A2.S.4
Beth's scores on the six Earth science tests she took this semester are 100, 95, 55, 85, 75, and 100. For this population, how many scores are within one standard deviation of the mean?

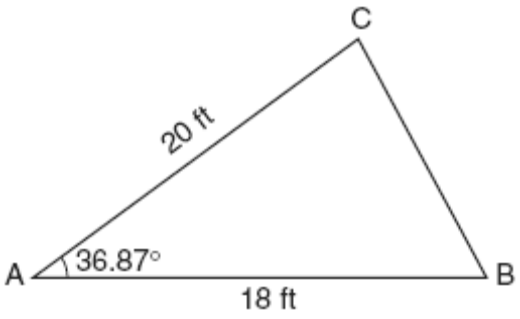
26. 080626b, P.I. G.G.61
Given point $A(-2,3)$. State the coordinates of the image of A under the composition $T_{-3,-4} \circ r_{x-axis}$. [The use of the accompanying grid is optional.]



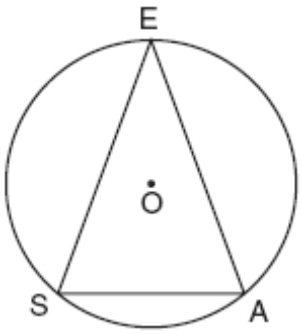
27. 080627b, P.I. G.G.44
In the accompanying diagram of circle *O*, diameter $\overline{AOB}$ is drawn, tangent $\overline{CB}$ is drawn to the circle at *B*, *E* is a point on the circle, and $\overline{BE} \parallel \overline{ADC}$. Prove: $\Delta ABE \sim \Delta CAB$



28. 080628b, P.I. A2.A.73
The accompanying diagram shows a triangular plot of land that is part of Fran's garden. She needs to change the dimensions of this part of the garden, but she wants the area to stay the same. She increases the length of side *AC* to 22.5 feet. If angle *A* remains the same, by how many feet should side *AB* be *decreased* to make the area of the new triangular plot of land the same as the current one?



29. 080629b, P.I. G.G.51
A machine part consists of a circular wheel with an inscribed triangular plate, as shown in the accompanying diagram. If $\overline{SE} \cong \overline{EA}$, $SE = 10$, and $m\widehat{SE} = 140$, find the length of $\overline{SA}$ to the *nearest tenth*.



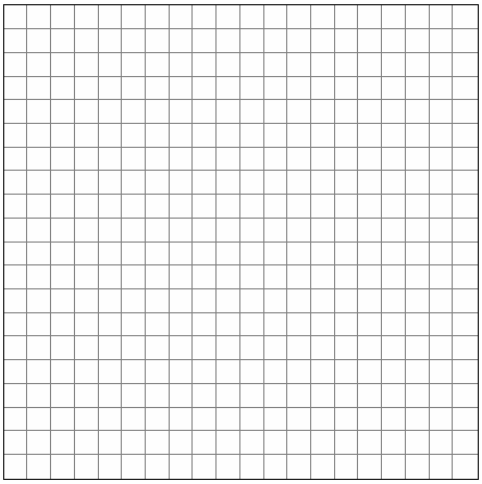
30. 080630b, P.I. A2.S.15
On mornings when school is in session in January, Sara notices that her school bus is late one-third of the time. What is the probability that during a 5-day school week in January her bus will be late *at least* three times?

31. 080631b, P.I. A2.S.7
Jean invested $380 in stocks. Over the next 5 years, the value of her investment grew, as shown in the accompanying table.

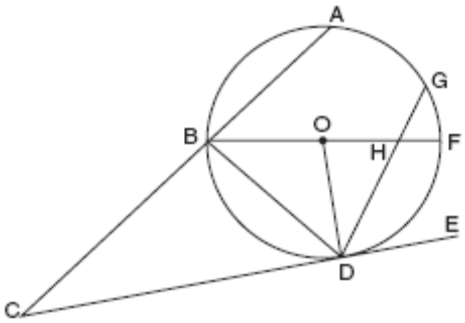
Years Since Investment (x)	Value of Stock, in Dollars (y)
0	380
1	395
2	411
3	427
4	445
5	462

Write the exponential regression equation for this set of data, rounding all values to *two decimal places.* Using this equation, find the value of her stock, to the *nearest dollar*, 10 years after her initial purchase.

32. 080632b, P.I. A2.A.27
After an oven is turned on, its temperature, *T*, is represented by the equation $T = 400 - 350(3.2)^{-0.1m}$ where *m* represents the number of minutes after the oven is turned on and *T* represents the temperature of the oven, in degrees Fahrenheit. How many minutes does it take for the oven's temperature to reach 300°F? Round your answer to the *nearest minute*. [The use of the grid is optional.]



33. 080633b, P.I. G.G.53
In the accompanying diagram, circle *O* has radius $\overline{OD}$, diameter $\overline{BOHF}$, secant $\overline{CBA}$, and chords $\overline{DHG}$ and $\overline{BD}$; $\overline{CE}$ is tangent to circle *O* at *D*; $m\overset{\frown}{DF} = 80$; and $m\overset{\frown}{BA} : m\overset{\frown}{AG} : m\overset{\frown}{GF} = 3:2:1$. Find $m\overset{\frown}{GF}$, and $m\angle BHD$, $m\angle BDG$, $m\angle GDE$, $m\angle C$, and $m\angle BOD$.



34. 080634b, P.I. A2.A.25
Barb pulled the plug in her bathtub and it started to drain. The amount of water in the bathtub as it drains is represented by the equation $L = -5t^2 - 8t + 120$, where *L* represents the number of liters of water in the bathtub and *t* represents the amount of time, in minutes, since the plug was pulled. How many liters of water were in the bathtub when Barb pulled the plug? Show your reasoning. Determine, to the *nearest tenth of a minute*, the amount of time it takes for all the water in the bathtub to drain.

[1] C

[2] C

[3] C

[4] D

[5] D

[6] A

[7] B

[8] C

[9] A

[10] C

[11] C

[12] C

[13] C

[14] B

[15] D

[16] A

[17] A

[18] B

[19] B

[20] B

[21]
[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 $3 + 4i$ 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.

[22]
[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 incorrect procedure.

[23]
[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.

[24]
[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.

[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.

[25]

[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.

[26]

[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.

[27]

[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.

[28]

[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.

[29]

[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.

[30]

[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.

[31]

[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.

[32]

[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.

[33]

[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 incorrect procedure.

[34]