1. 080201b, P.I. A2.S.15
Which fraction represents the probability of obtaining *exactly* eight heads in ten tosses of a fair coin?

[A] $\frac{64}{1{,}024}$ [B] $\frac{90}{1{,}024}$

[C] $\frac{180}{1{,}024}$ [D] $\frac{45}{1{,}024}$

2. 080202b, P.I. A2.S.5
In a New York City high school, a survey revealed the mean amount of cola consumed each week was 12 bottles and the standard deviation was 2.8 bottles. Assuming the survey represents a normal distribution, how many bottles of cola per week will approximately 68.2% of the students drink?

[A] 9.2 to 14.8 [B] 12 to 20.4

[C] 6.4 to 17.6 [D] 6.4 to 12

3. 080203b, P.I. A2.A.1
What is the solution of the inequality $|x+3| \le 5$?

[A] $-2 \le x \le 8$ [B] $x \le -8$ *or* $x \ge 2$

[C] $-8 \le x \le 2$ [D] $x \le -2$ *or* $x \ge 8$

4. 080204b, P.I. A2.A.39
What is the domain of $f(x) = 2^x$?

[A] all real numbers [B] all integers

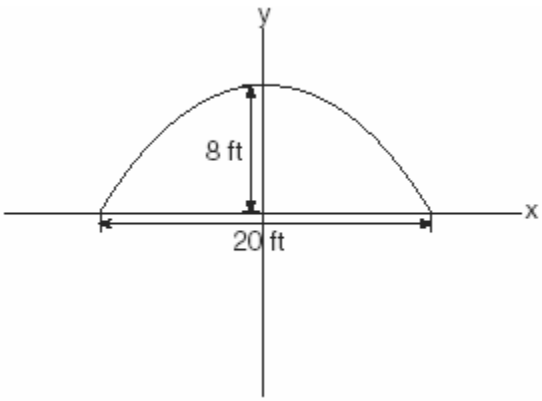
[C] $x \le 0$ [D] $x \ge 0$

5. 080205b, P.I. A2.A.44
A function is defined by the equation $y = 5x - 5$. Which equation defines the inverse of this function?

[A] $x = \frac{1}{5y-5}$ [B] $y = \frac{1}{5x-5}$

[C] $x = 5y - 5$ [D] $y = 5x + 5$

6. 080206b
An architect is designing a building to include an arch in the shape of a semi-ellipse (half an ellipse), such that the width of the arch is 20 feet and the height of the arch is 8 feet, as shown in the accompanying diagram.



Which equation models this arch?

[A] $\frac{x^2}{100} + \frac{y^2}{64} = 1$ [B] $\frac{x^2}{400} + \frac{y^2}{64} = 1$

[C] $\frac{x^2}{64} + \frac{y^2}{100} = 1$ [D] $\frac{x^2}{64} + \frac{y^2}{400} = 1$

7. 080207b, P.I. A2.A.5
To balance a seesaw, the distance, in feet, a person is from the fulcrum is inversely proportional to the person's weight, in pounds. Bill, who weighs 150 pounds, is sitting 4 feet away from the fulcrum. If Dan weighs 120 pounds, how far from the fulcrum should he sit to balance the seesaw?

[A] 3 ft [B] 3.5 ft [C] 4.5 ft [D] 5 ft

8. 080208b, P.I. A2.A.36
What is the *last* term in the expansion of $(x+2y)^5$?

[A] $2y^5$ [B] y^5 [C] $10y^5$ [D] $32y^5$

9. 080209b, P.I. A2.A.28
In the equation $\log_x 4 + \log_x 9 = 2$, x is equal to

[A] 6 [B] 6.5 [C] $\sqrt{13}$ [D] 18

10. 080210b, P.I. A2.N.5
Which expression represents the sum of $\frac{1}{\sqrt{3}}+\frac{1}{\sqrt{2}}$?

[A] $\frac{2\sqrt{3}+3\sqrt{2}}{6}$ [B] $\frac{\sqrt{3}+\sqrt{2}}{2}$

[C] $\frac{\sqrt{3}+\sqrt{2}}{3}$ [D] $\frac{2}{\sqrt{5}}$

11. 080211b, P.I. A2.A.2
Which equation has imaginary roots?

[A] $x^2-1=0$ [B] $x^2+x+1=0$

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

12. 080212b, P.I. A2.A.19
If $\log k = c\log v + \log p$, k equals

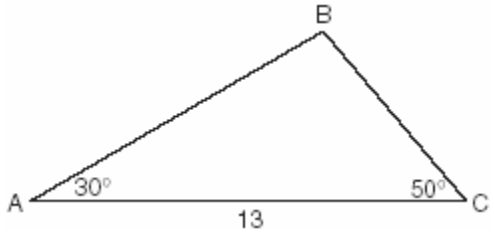
[A] $cv+p$ [B] $v^c p$

[C] $(vp)^c$ [D] v^c+p

13. 080213b, P.I. A2.N.10
If ${}_nC_r$ represents the number of combinations of n items taken r at a time, what is the value of $\sum_{r=1}^{3} {}_4C_r$?

[A] 4 [B] 6 [C] 14 [D] 24

14. 080214b, P.I. A2.A.73
In the accompanying diagram of ΔABC, $m\angle A = 30$, $m\angle C = 50$, and $AC = 13$.



What is the length of side $\overline{AB}$ to the *nearest tenth*?

[A] 12.0 [B] 10.1 [C] 6.6 [D] 11.5

15. 080215b, P.I. A2.N.9
Expressed in simplest form, $i^{16}+i^6-2i^5+i^{13}$

[A] 1 [B] $-i$ [C] i [D] -1

16. 080216b
If the point (a, b) lies on the graph $y = f(x)$, the graph of $y = f^{-1}(x)$ must contain point

[A] (0,b) [B] (a,0)

[C] (-a,-b) [D] (b,a)

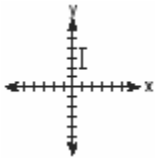
17. 080217b
If the sum of the roots of x^2+3x-5 is added to the product of its roots, the result is

[A] -8 [B] 15 [C] -2 [D] -15

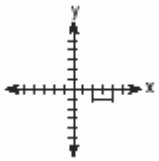
18. 080218b, P.I. A2.N.1
The expression $\frac{3^{\frac{1}{3}}}{3^{-\frac{2}{3}}}$ is equivalent to

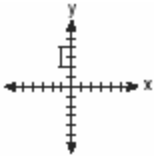
[A] $\frac{1}{\sqrt[3]{3}}$ [B] 3 [C] 1 [D] $\sqrt{3}$

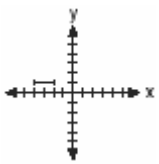
19. 080219b, P.I. G.G.61
The accompanying graph represents the figure ⌶.

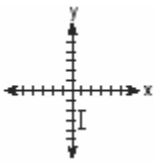


Which graph represents ⌶ after a transformation defined by $r_{y=x} \circ R_{90°}$?

[A] 

[B] 

[C] 

[D] 

20. 080220b, P.I. A2.A.17
Which expression is equivalent to the complex fraction $\dfrac{\dfrac{x}{x+2}}{1-\dfrac{x}{x+2}}$?

[A] $\dfrac{2x}{x+2}$ [B] $\dfrac{x}{2}$ [C] $\dfrac{2x}{x^2+4}$ [D] $\dfrac{2}{x}$

21. 080221b, P.I. A.A.9
A used car was purchased in July 1999 for $11,900. If the car depreciates 13% of its value each year, what is the value of the car, to the *nearest hundred dollars*, in July 2002?

22. 080222b, P.I. A2.S.5
The amount of time that a teenager plays video games in any given week is normally distributed. If a teenager plays video games an average of 15 hours per week, with a standard deviation of 3 hours, what is the probability of a teenager playing video games between 15 and 18 hours a week?

23. 080223b
An art student wants to make a string collage by connecting six equally spaced points on the circumference of a circle to its center with string. What would be the radian measure of the angle between two adjacent pieces of string, in simplest form?

24. 080224b, P.I. A.A.9
The Franklins inherited $3,500, which they want to invest for their child's future college expenses. If they invest it at 8.25% with interest compounded monthly, determine the value of the account, in dollars, after 5 years.

Use the formula $A = P(1+\frac{r}{n})^{nt}$, where A = value of the investment after t years, P = principal invested, r = annual interest rate, and n = number of times compounded per year.

25. 080225b
A toy truck is located within a circular play area. Alex and Dominic are sitting on opposite endpoints of a chord that contains the truck. Alex is 4 feet from the truck, and Dominic is 3 feet from the truck. Meira and Tamara are sitting on opposite endpoints of another chord containing the truck. Meira is 8 feet from the truck. How many feet, to the *nearest tenth of a foot*, is Tamara from the truck? Draw a diagram to support your answer.

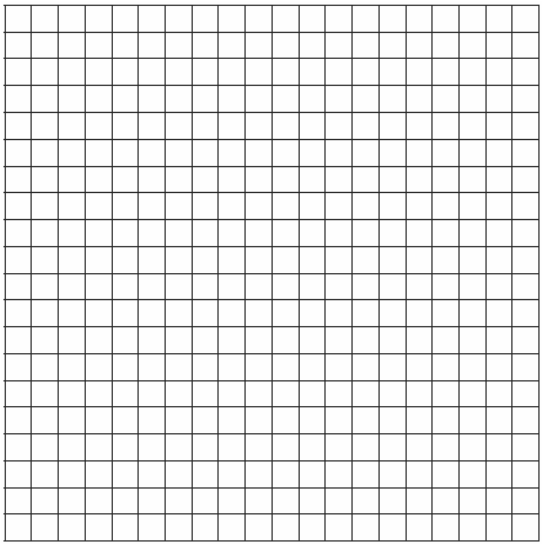
26. 080226b, P.I. A2.A.73
Two sides of a triangular-shaped pool measure 16 feet and 21 feet, and the included angle measures 58°. What is the area, to the *nearest tenth of a square foot*, of a nylon cover that would exactly cover the surface of the pool?

27. 080227b, P.I. A2.A.23
The cost (C) of selling x calculators in a store is modeled by the equation $C = \dfrac{3{,}200{,}000}{x} + 60{,}000$. The store profit ($P$) for these sales is modeled by the equation $P = 500x$. What is the minimum number of calculators that have to be sold for profit to be greater than cost?

28. 080228b, P.I. A2.A.73
Two tow trucks try to pull a car out of a ditch. One tow truck applies a force of 1,500 pounds while the other truck applies a force of 2,000 pounds. The resultant force is 3,000 pounds. Find the angle between the two applied forces, rounded to the *nearest degree*.

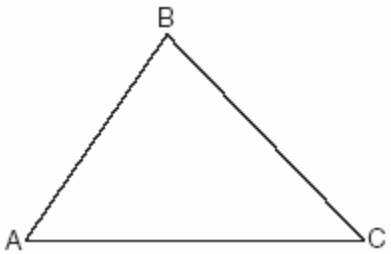
29. 080229b, P.I. A.A.41

A rock is thrown vertically from the ground with a velocity of 24 meters per second, and it reaches a height of $2+24t-4.9t^2$ after t seconds. How many seconds after the rock is thrown will it reach maximum height, and what is the maximum height the rock will reach, in meters? How many seconds after the rock is thrown will it hit the ground? Round your answers to the *nearest hundredth.* [Only an algebraic or graphic solution will be accepted.]



30. 080230b, P.I. G.G.27

In the accompanying diagram, ΔABC is *not* isosceles. Prove that if altitude $\overline{BD}$ were drawn, it would *not* bisect $\overline{AC}$.



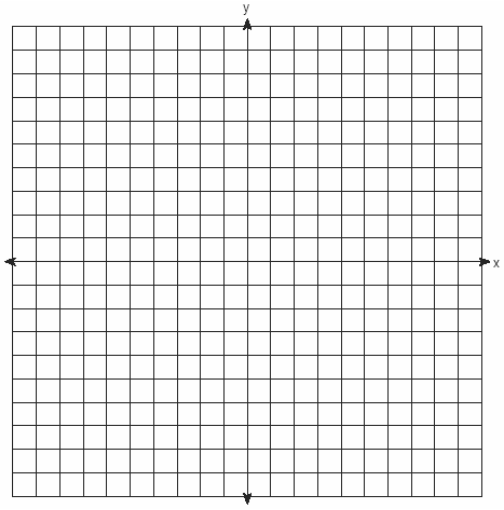
31. 080231b, P.I. G.G.61

Graph and label the following equations, *a* and *b*, on the accompanying set of coordinate axes.

$$a: y = x^2$$

$$b: y = -(x-4)^2 + 3$$

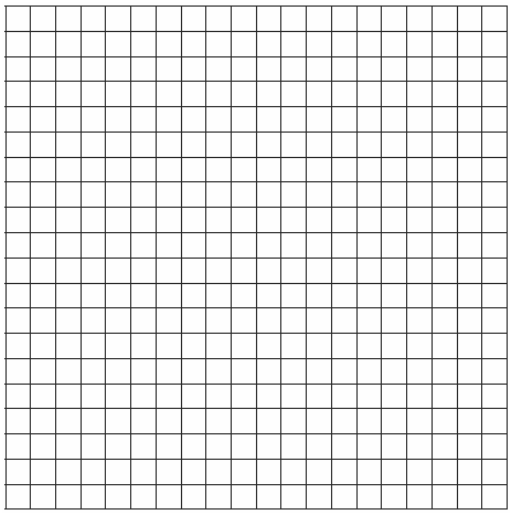
Describe the composition of transformations performed on *a* to get *b*.



32. 080232b, P.I. A2.S.7
The breaking strength, *y*, in tons, of steel cable with diameter *d*, in inches, is given in the table below.

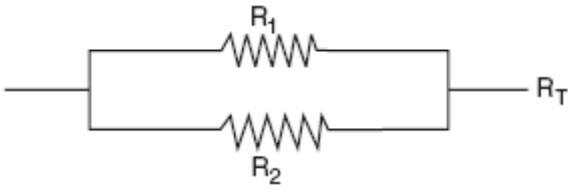
d (in)	*y* (tons)
0.50	9.85
0.75	21.80
1.00	38.30
1.25	59.20
1.50	84.40
1.75	114.00

On the accompanying grid, make a scatter plot of these data. Write the exponential regression equation, expressing the regression coefficients to the *nearest tenth.*



33. 080233b, P.I. A2.A.73
Carmen and Jamal are standing 5,280 feet apart on a straight, horizontal road. They observe a hot-air balloon between them directly above the road. The angle of elevation from Carmen is 60° and from Jamal is 75°. Draw a diagram to illustrate this situation and find the height of the balloon to the *nearest foot.*

34. 080234b, P.I. A2.A.23
Electrical circuits can be connected in series, one after another, or in parallel circuits that branch off a main line. If circuits are hooked up in parallel, the reciprocal of the total resistance in the series is found by adding the reciprocals of each resistance, as shown in the accompanying diagram.



$$\frac{1}{R_1}+\frac{1}{R_2}=\frac{1}{R_T}$$

If $R_1 = x$, $R_2 = x+3$, and the total resistance, R_T, is 2.25 ohms, find the positive value of R_1 to the *nearest tenth of an ohm.*

[1] D

[2] A

[3] C

[4] A

[5] C

[6] A

[7] D

[8] D

[9] A

[10] A

[11] B

[12] B

[13] C

[14] B

[15] B

[16] D

[17] A

[18] B

[19] D

[20] B

[21]
[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.

[22]
[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.

[23]
[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.

[24]
[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.

[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.

[25]

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[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.

[26]

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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.

[27]

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[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.

[28]

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[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.

[29]

[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.

[30]

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[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.

[31]

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[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.

[32]

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[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.

[33]

[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.

[34]