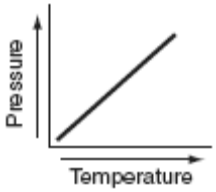
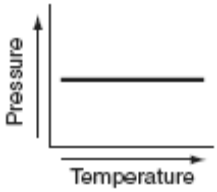
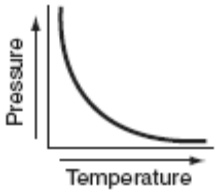
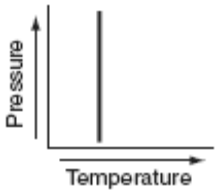
1. 060601b, P.I. A.G.3
Each graph below represents a possible relationship between temperature and pressure. Which graph does *not* represent a function?

[A] 

[B] 

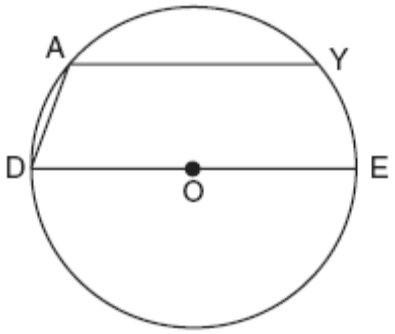
[C] 

[D] 

2. 060602b, P.I. A2.A.8
If $f(x) = x^{-\frac{3}{2}}$, then $f(\frac{1}{4})$ is equal to

[A] 8 [B] -2 [C] $-\frac{1}{8}$ [D] -4

3. 060603b
In the accompanying diagram of circle *O*, chord $\overline{AY}$ is parallel to diameter $\overline{DOE}$, $\overline{AD}$ is drawn, and $m\overset{\frown}{AD} = 40$.



What is $m\angle DAY$?

[A] 150 [B] 110 [C] 90 [D] 130

4. 060604b, P.I. A2.A.77
If *x* is a positive acute angle and $\sin x = \frac{1}{2}$, what is $\sin 2x$?

[A] $\frac{1}{2}$ [B] $-\frac{\sqrt{3}}{2}$ [C] $-\frac{1}{2}$ [D] $\frac{\sqrt{3}}{2}$

5. 060605b, P.I. A2.A.42
The temperature generated by an electrical circuit is represented by $t = f(m) = 0.3m^2$, where *m* is the number of moving parts. The resistance of the same circuit is represented by $r = g(t) = 150 + 5t$, where *t* is the temperature. What is the resistance in a circuit that has four moving parts?

[A] 156 [B] 51 [C] 8,670 [D] 174

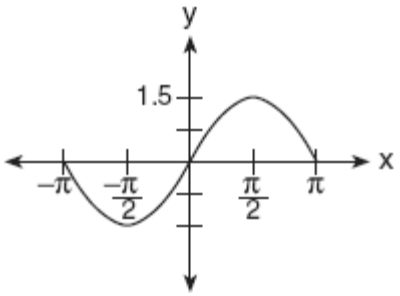
6. 060606b, P.I. A.A.8
If the equation $x^2 - kx - 36 = 0$ has $x = 12$ as one root, what is the value of *k*?

[A] 9 [B] -9 [C] -3 [D] 3

7. 060607b, P.I. A.A.9
The height, f(*x*), of a bouncing ball after *x* bounces is represented by $f(x) = 80(0.5)^x$. How many times higher is the first bounce than the fourth bounce?

[A] 4 [B] 2 [C] 16 [D] 8

8. 060608b, P.I. A2.A.72
A radio transmitter sends a radio wave from the top of a 50-foot tower. The wave is represented by the accompanying graph.



What is the equation of this radio wave?

[A] $y = \sin x$ [B] $y = \sin 1.5x$

[C] $y = 1.5\sin x$ [D] $y = 2\sin x$

9. 060609b, P.I. A2.A.58
If $\tan\theta = 2.7$ and $\csc\theta < 0$, in which quadrant does θ lie?

[A] III [B] I [C] II [D] IV

10. 060610b, P.I. A2.A.67
The expression $\frac{1-\cos^2 x}{\sin^2 x}$ is equivalent to

[A] $\sin x$ [B] $\cos x$ [C] -1 [D] 1

11. 060611b, P.I. A.A.41
The graph of $y = (x-3)^2$ is shifted left 4 units and down 2 units. What is the axis of symmetry of the transformed graph?

[A] $x = 1$ [B] $x = -2$

[C] $x = 7$ [D] $x = -1$

12. 060612b, P.I. A2.A.27
The solution set of $2^{x^2+2x} = 2^{-1}$ is

[A] {-1} [B] {-1, 1} [C] { } [D] {1}

13. 060613b, P.I. A2.A.46
Which transformation best describes the relationship between the functions $f(x) = 2^x$ and $g(x) = (\frac{1}{2})^x$?

[A] reflection in the *y*-axis

[B] reflection in the origin

[C] reflection in the line $y = x$

[D] reflection in the *x*-axis

14. 060614b
What is the multiplicative inverse of $3i$?

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

15. 060615b, P.I. A2.N.7
Mrs. Donahue made up a game to help her class learn about imaginary numbers. The winner will be the student whose expression is equivalent to $-i$. Which expression will win the game?

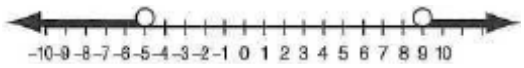
[A] i^{48} [B] i^{46} [C] i^{47} [D] i^{49}

16. 060616b
Which equation represents a hyperbola?

[A] $y^2 = 16 - x^2$ [B] $y = 16x^2$

[C] $y = \frac{16}{x}$ [D] $y = 16 - x^2$

17. 060617b, P.I. A2.A.1
The solution set of which inequality is represented by the accompanying graph?



[A] $|2-x|>-7$ [B] $|2-x|<-7$

[C] $|x-2|<7$ [D] $|x-2|>7$

18. 060618b, P.I. A2.A.5
According to Boyle's Law, the pressure, *p*, of a compressed gas is inversely proportional to the volume, *v*. If a pressure of 20 pounds per square inch exists when the volume of the gas is 500 cubic inches, what is the pressure when the gas is compressed to 400 cubic inches?

[A] $40\ \text{lb}/\text{in}^2$ [B] $16\ \text{lb}/\text{in}^2$

[C] $25\ \text{lb}/\text{in}^2$ [D] $50\ \text{lb}/\text{in}^2$

19. 060619b, P.I. A2.A.36
What is the fourth term in the expansion of $(y-1)^7$?

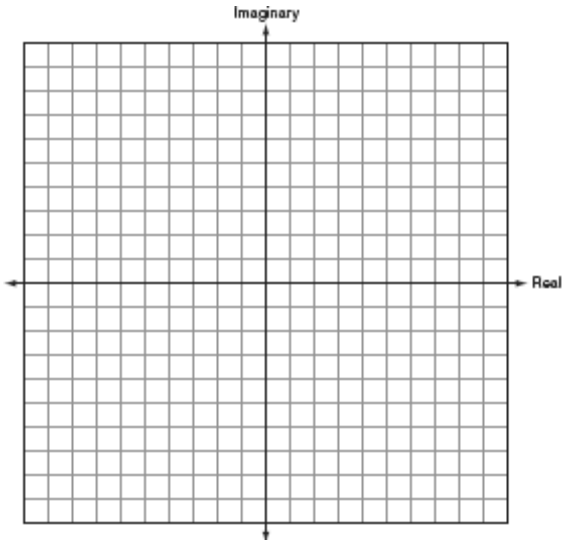
[A] $-35y^4$ [B] $-35y^3$

[C] $35y^3$ [D] $35y^4$

20. 060620b, P.I. A2.A.75
Sam needs to cut a triangle out of a sheet of paper. The only requirements that Sam must follow are that one of the angles must be 60°, the side opposite the 60° angle must be 40 centimeters, and one of the other sides must be 15 centimeters. How many different triangles can Sam make?

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

21. 060621b
Find the sum of -2 + 3*i* and -1 - 2*i*. Graph the resultant on the accompanying set of axes.



22. 060622b, P.I. A2.A.73
In ΔABC, $m\angle A=53$, $m\angle B=14$, and $a=10$. Find *b* to the *nearest integer*.

23. 060623b, P.I. A2.A.28
Solve for *x*: $\log_2(x+1)=3$

24. 060624b, P.I. A2.N.10
Evaluate: $\sum_{k=1}^{2}\frac{(-1)^{k-1}}{(2k-1)!}$

25. 060625b, P.I. A2.S.15
Ginger and Mary Anne are planning a vacation trip to the island of Capri, where the probability of rain on any day is 0.3. What is the probability that during their five days on the island, they have *no* rain on *exactly* three of the five days?

26. 060626b
The pendulum of a clock swings through an angle of 2.5 radians as its tip travels through an arc of 50 centimeters. Find the length of the pendulum, in centimeters.

27. 060627b
Solve the following system of equations algebraically:

$$9x^2 + y^2 = 9$$
$$3x - y = 3$$

28. 060628b, P.I. A2.A.17
Simplify for all values of a for which the expression is defined: $\dfrac{1-\frac{2}{a}}{\frac{4}{a^2}-1}$

29. 060629b, P.I. A2.A.22
Solve algebraically for x: $\sqrt{3x+1}+1=x$

30. 060630b, P.I. A2.S.4
The number of children of each of the first 41 United States presidents is given in the accompanying table. For this population, determine the mean and the standard deviation to the *nearest tenth*. How many of these presidents fall within one standard deviation of the mean?

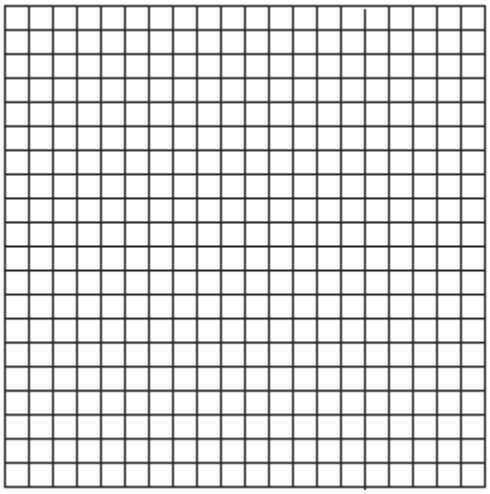
Number of Children (x_i)	Number of Presidents (f_i)
0	6
1	2
2	8
3	6
4	7
5	3
6	5
7	1
8	1
10	1
15	1

31. 060631b, P.I. A2.S.7
A factory is producing and stockpiling metal sheets to be shipped to an automobile manufacturing plant. The factory ships only when there is a minimum of 2,050 sheets in stock. The accompanying table shows the day, x, and the number of sheets in stock, f(x).

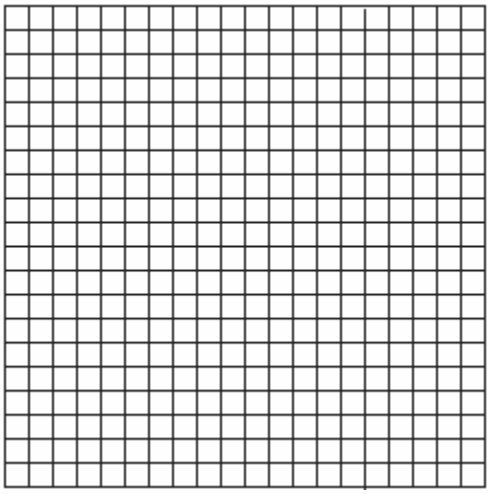
Day (x)	Sheets in Stock ($f(x)$)
1	860
2	930
3	1000
4	1150
5	1200
6	1360

Write the linear regression equation for this set of data, rounding the coefficients to *four decimal places*. Use this equation to determine the day the sheets will be shipped.

32. 060632b, P.I. A.G.4
A small rocket is launched from a height of 72 feet. The height of the rocket in feet, *h*, is represented by the equation $h(t) = -16t^2 + 64t + 72$, where *t* = time, in seconds. Graph this equation on the accompanying grid. Use your graph to determine the number of seconds that the rocket will remain at or above 100 feet from the ground. [Only a graphic solution can receive full credit.]



33. 060633b, P.I. G.G.69
Given: *A*(-2,2), *B*(6,5), *C*(4,0), *D*(-4,-3)
Prove: *ABCD* is a parallelogram but not a rectangle. [The use of the grid is optional.]



34. 060634b, P.I. A2.A.73
A triangular plot of land has sides that measure 5 meters, 7 meters, and 10 meters. What is the area of this plot of land, to the *nearest tenth of a square meter*?

[1] D

[2] A

[3] B

[4] D

[5] D

[6] A

[7] D

[8] C

[9] A

[10] D

[11] D

[12] A

[13] A

[14] A

[15] C

[16] C

[17] D

[18] C

[19] A

[20] C

[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
[21] incorrect procedure.

[2] 3, and appropriate work is shown, such as $\frac{10}{\sin 53^\circ} = \frac{b}{\sin 14^\circ}$.
[1] Appropriate work is shown, but one computational or rounding error is made.
or [1] The proportion $\frac{10}{\sin 53^\circ} = \frac{b}{\sin 14^\circ}$ 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
[22] incorrect procedure.

[2] 7, and appropriate work is shown, such as $2^3 = x + 1$.
[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] $2^3 = x + 1$ 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
[23] incorrect procedure.

[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
[24] incorrect procedure.

[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.

[25]

[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.

[26]

[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.

[27]

[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.

[28]

[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.

[29]

[30]
[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.

[31]
[4] $f(x) = 98.8571x + 737.3333$ or $y = 98.8571x + 737.3333$ and day 14, and appropriate substitution is made, such as $2050 = 98.8571x + 737.3333$.
[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 $98.8571x + 737.3333$ 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 $98.8571x + 737.3333$ 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.

[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.

[32]

[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.

[33]

[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.

[34]