

1. 060401b, P.I. A2.N.9

What is the sum of $2 - \sqrt{-4}$ and $-3 + \sqrt{-16}$ expressed in simplest $a + bi$ form?

[A] $-14 + i$ [B] $-1 + 12i$

[C] $-1 + i\sqrt{20}$ [D] $-1 + 2i$

2. 060402b, P.I. A2.S.15

The Hiking Club plans to go camping in a State park where the probability of rain on any given day is 0.7. Which expression can be used to find the probability that it will rain on *exactly* three of the seven days they are there?

[A] ${}_7C_3(0.3)^3(0.7)^4$ [B] ${}_4C_3(0.7)^3(0.7)^4$

[C] ${}_4C_3(0.4)^4(0.3)^3$ [D] ${}_7C_3(0.7)^3(0.3)^4$

3. 060403b, P.I. A2.A.69

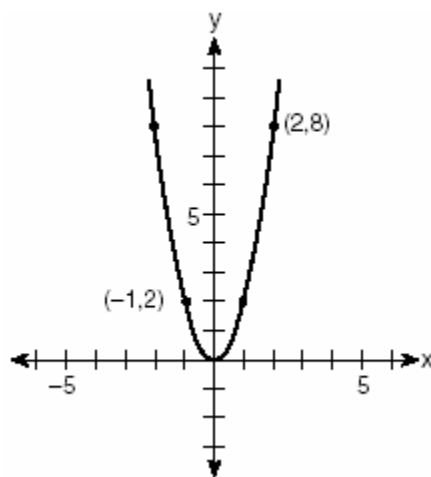
What is the amplitude of the function

$$y = \frac{2}{3} \sin 4x ?$$

[A] $\frac{2}{3}$ [B] $\frac{\pi}{2}$ [C] 4 [D] 3π

4. 060404b, P.I. A.G.4

Which quadratic function is shown in the accompanying graph?



[A] $y = \frac{1}{2}x^2$

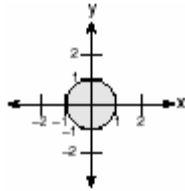
[B] $y = -2x^2$

[C] $y = 2x^2$

[D] $y = -\frac{1}{2}x^2$

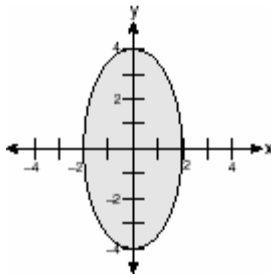
5. 060405b, P.I. G.G.60

In the accompanying graph, the shaded region represents set A of all points (x,y) such that $x^2 + y^2 \leq 1$. The transformation T maps point (x, y) to point $(2x, 4y)$.

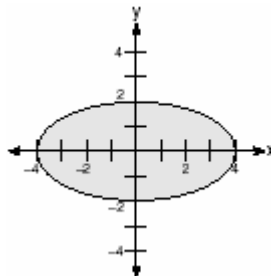


Which graph shows the mapping of set A by the transformation T ?

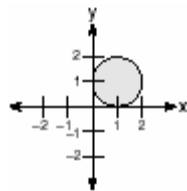
[A]



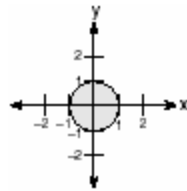
[B]



[C]



[D]



6. 060406b, P.I. A2.A.41

If $f(x) = 4x^0 + (4x)^{-1}$, what is the value of $f(4)$?

- [A] 0 [B] -12 [C] $4\frac{1}{16}$ [D] $1\frac{1}{16}$

7. 060407b, P.I. A2.A.39

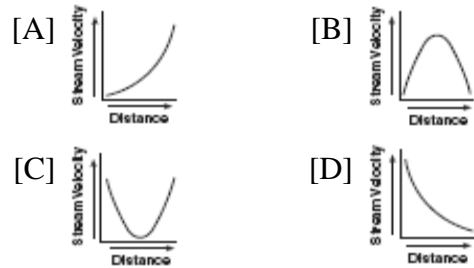
What is the domain of the function

$$f(x) = \frac{2x^2}{x^2 - 9}$$

- [A] all real numbers except 3 and -3
[B] all real numbers
[C] all real numbers except 3
[D] all real numbers except 0

8. 060408b

Which graph represents an inverse variation between stream velocity and the distance from the center of the stream?



9. 060409b, P.I. A2.A.19

If $\log_b x = y$, then x equals

- [A] b^y [B] $y \cdot b$ [C] y^b [D] $\frac{y}{b}$

10. 060410b, P.I. A2.N.9

The expression $i^0 \cdot i^1 \cdot i^2 \cdot i^3 \cdot i^4$ is equal to

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

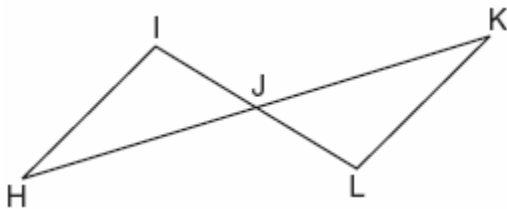
19. 060419b, P.I. A2.A.11

The expression $\sqrt[4]{16a^6b^4}$ is equivalent to

- [A] $4a^2b$ [B] $4a^{\frac{3}{2}}b$
[C] $2a^{\frac{3}{2}}b$ [D] $2a^2b$

20. 060420b, P.I. G.G.28

In the accompanying diagram, \overline{HK} bisects \overline{IL} and $\angle H \cong \angle K$.



What is the most direct method of proof that could be used to prove $\triangle HIJ \cong \triangle KLJ$?

- [A] $HL \cong HL$ [B] $ASA \cong ASA$
[C] $SAS \cong SAS$ [D] $AAS \cong AAS$

21. 060421b, P.I. A2.N.10

The projected total annual profits, in dollars, for the Nutyme Clothing Company from 2002 to 2004 can be approximated by the model

$$\sum_{n=0}^2 (13,567n + 294),$$

where n is the year and

$n = 0$ represents 2002. Use this model to find the company's projected total annual profits, in dollars, for the period 2002 to 2004.

22. 060422b, P.I. A2.A.27

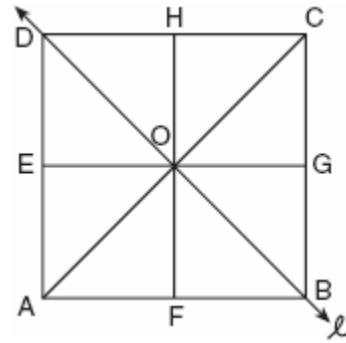
Solve algebraically for x : $27^{2x+1} = 9^{4x}$

23. 060423b, P.I. A2.A.2

Find all values of k such that the equation $3x^2 - 2x + k = 0$ has imaginary roots.

24. 060424b, P.I. G.G.56

In the accompanying diagram of square $ABCD$, F is the midpoint of \overline{AB} , G is the midpoint of \overline{BC} , H is the midpoint of \overline{CD} , and E is the midpoint of \overline{DA} .

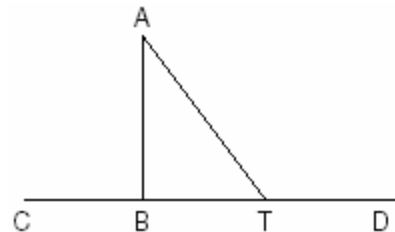


Find the image of $\triangle EOA$ after it is reflected in line l .

Is this isometry direct or opposite? Explain your answer.

25. 060425b, P.I. G.G.31

Given: $\triangle ABT$, \overline{CBTD} , and $\overline{AB} \perp \overline{CD}$

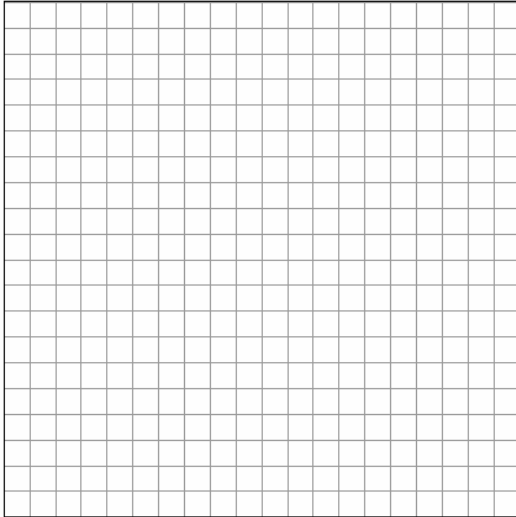


Write an indirect proof to show that \overline{AT} is not perpendicular to \overline{CD} .

26. 010532b, P.I. A2.A.22

The equation $V = 20\sqrt{C + 273}$ relates speed of sound, V , in meters per second, to air temperature, C , in degrees Celsius. What is the temperature, in degrees Celsius, when the speed of sound is 320 meters per second?

[The use of the accompanying grid is optional.]



27. 060427b, P.I. A2.A.68

Navigators aboard ships and airplanes use nautical miles to measure distance. The length of a nautical mile varies with latitude. The length of a nautical mile, L , in feet, on the latitude line θ is given by the formula $L = 6,077 - 31\cos 2\theta$. Find, to the nearest degree, the angle θ , $0 \leq \theta \leq 90^\circ$, at which the length of a nautical mile is approximately 6,076 feet.

28. 060428b, P.I. A2.A.73

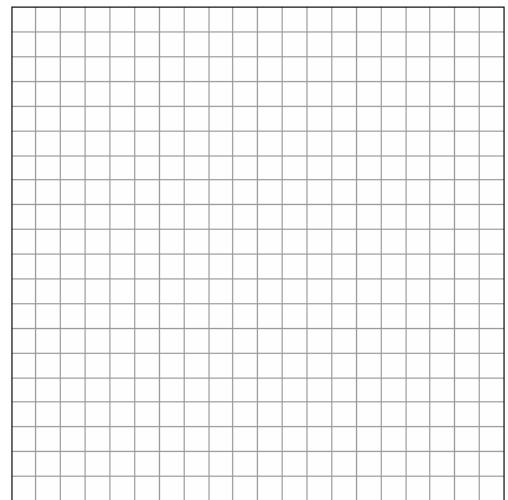
Two equal forces act on a body at an angle of 80° . If the resultant force is 100 newtons, find the value of one of the two equal forces, to the nearest hundredth of a newton.

29. 060429b, P.I. A2.A.23

Solve for x and express your answer in simplest radical form: $\frac{4}{x} - \frac{3}{x+1} = 7$

30. 060430b, P.I. A.A.41

A baseball player throws a ball from the outfield toward home plate. The ball's height above the ground is modeled by the equation $y = -16x^2 + 48x + 6$ where y represents height, in feet, and x represents time, in seconds. The ball is initially thrown from a height of 6 feet. How many seconds after the ball is thrown will it again be 6 feet above the ground? What is the maximum height, in feet, that the ball reaches? [The use of the accompanying grid is optional.]



31. 060431b, P.I. A2.A.27

An archaeologist can determine the approximate age of certain ancient specimens by measuring the amount of carbon-14, a radioactive substance, contained in the specimen. The formula used to determine the age of a specimen is $A = A_0 2^{\frac{-t}{5760}}$, where A is the amount of carbon-14 that a specimen contains, A_0 is the original amount of carbon-14, t is time, in years, and 5760 is the half-life of carbon-14. A specimen that originally contained 120 milligrams of carbon-14 now contains 100 milligrams of this substance. What is the age of the specimen, to the nearest hundred years?

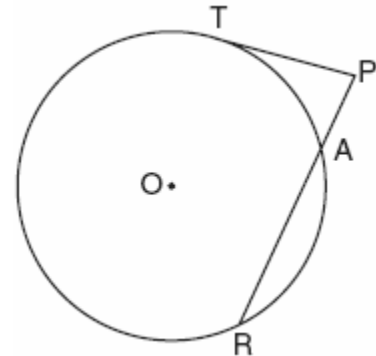
32. 060432b, P.I. A2.S.5

Mrs. Ramírez is a real estate broker. Last month, the sale prices of homes in her area approximated a normal distribution with a mean of \$150,000 and a standard deviation of \$25,000. A house had a sale price of \$175,000. What is the percentile rank of its sale price, to the nearest whole number? Explain what that percentile means. Mrs. Ramírez told a customer that most of the houses sold last month had selling prices between \$125,000 and \$175,000. Explain why she is correct.

33. 060433b, P.I. G.G.53

The accompanying diagram shows a circular machine part that has rods \overline{PT} and \overline{PAR} attached at points T , A , and R , which are located on the circle;

$m\widehat{TA} : m\widehat{AR} : m\widehat{RT} = 1 : 3 : 5$; $RA = 12$ centimeters; and $PA = 5$ centimeters.



Find the measure of $\angle P$, in degrees, and find the length of rod \overline{PT} , to the nearest tenth of a centimeter.

34. 060434b, P.I. A2.A.73

A surveyor is mapping a triangular plot of land. He measures two of the sides and the angle formed by these two sides and finds that the lengths are 400 yards and 200 yards and the included angle is 50° . What is the measure of the third side of the plot of land, to the nearest yard? What is the area of this plot of land, to the nearest square yard?

- [1] D
- [2] D
- [3] A
- [4] C
- [5] A
- [6] C
- [7] A
- [8] D
- [9] A
- [10] D
- [11] A
- [12] C
- [13] C
- [14] B
- [15] C
- [16] D
- [17] B
- [18] C
- [19] C
- [20] D

[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

[21] incorrect procedure.

[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

[22] incorrect procedure.

[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

[23] incorrect procedure.

[2] Δ HOC and opposite, and an appropriate explanation is written.

[1] The image of Δ 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] Δ 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

[24] obviously incorrect procedure.

[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

[25] incorrect procedure.

[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

[26] incorrect procedure.

[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

[27] incorrect procedure.

[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

[28] 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

[29] incorrect procedure.

[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.

[30]

[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

[31] incorrect procedure.

- [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.
-

- [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.
-

[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

[34] incorrect procedure.