Example Items

Pre-Calculus

Pre-Calculus Example Items are a **representative set** of items for the ACP. Teachers may use this set of items along with the test blueprint as guides to prepare students for the ACP. On the last page, the correct answer, content SE and SE justification are listed for each item.

The specific part of an SE that an Example Item measures is NOT necessarily the only part of the SE that is assessed on the ACP. None of these Example Items will appear on the ACP.

Teachers may provide feedback regarding Example Items.

(1) Download the Example Feedback Form and email it. The form is located on the homepage of the Assessment website: https://assessment.dallasisd.org.

OR

(2) To submit directly, click "Example Feedback – online form" **after** you click the Example Items link under ACP Resources on the ACP tab on the Assessment website.

Second Semester
2020–2021
Code #: 1121

ACP Formulas
Pre-Calculus/Pre-Calculus PAP
2020 – 2021

Trigonometric Functions and Identities

Pythagorean Theorem:		$a^2 + b^2 = c^2$	
Special Right Triangles:		30° - 60° - 90°	$x, x\sqrt{3}, 2x$
		45° - 45° - 90°	$x, x, x\sqrt{2}$
Law of Sines:	$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$	Heron's Formula:	$A = \sqrt{s(s-a)(s-b)(s-c)}$
Law of Cosines:	$a^2 = b^2 + c^2 - 2bc \cos A$	$b^2 = a^2 + c^2 - 2ac \cos B$	$c^2 = a^2 + b^2 - 2ab \cos C$
Linear Velocity:	$v = r \cdot \omega \qquad v = r \cdot \frac{\theta}{t}$	Angular Velocity:	$\omega = \frac{\theta}{t}$
Reciprocal Identities:	$\sin\theta = \frac{1}{\csc\theta}$	$\cos\theta = \frac{1}{\sec\theta}$	$\tan\theta = \frac{1}{\cot\theta}$
	$\csc\theta = \frac{1}{\sin\theta}$	$\sec\theta = \frac{1}{\cos\theta}$	$\cot\theta = \frac{1}{\tan\theta}$
Pythagorean Identities:	$\sin^2\theta + \cos^2\theta = 1$	$1 + \tan^2\theta = \sec^2\theta$	$1 + \cot^2\theta = \csc^2\theta$
Sum & Difference Identities:	$\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$	$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$	
	$\cos(\alpha-\beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$	$\sin(\alpha-\beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$	
Double-Angle Identities:	$\sin 2\theta = 2\sin\theta\cos\theta$	$\cos 2\theta = \cos^2\theta - \sin^2\theta$	
	$\cos 2\theta = 2\cos^2\theta - 1$	$\cos 2\theta = 1 - 2\sin^2\theta$	

Sequences and Series

The n^{th} Term of an Arithmetic Sequence:	$a_n = a_1 + (n-1)d$	The n^{th} Term of a Geometric Sequence:	$a_n = a_1 r^{n-1}$
Sum of a Finite Arithmetic Series:	$\sum_{k=1}^{n} a_k = \frac{n}{2}(a_1 + a_n)$	$S_n = \frac{n}{2}\left[2a_1 + (n-1)d\right]$	
Sum of a Finite Geometric Series:	$\sum_{k=1}^{n} a_k = \frac{a_1(1-r^n)}{1-r}, \ \lvert r\rvert \neq 1$	$S_n = \frac{a_1 - a_n r}{1-r}, \ \lvert r\rvert \neq 1$	
Sum of an Infinite Geometric Series:	$\sum_{n=1}^{\infty} a_n = \frac{a_1}{1-r}, \ \lvert r\rvert < 1$		
Binomial Theorem:	$(a+b)^n = {}_nC_0 a^n b^0 + {}_nC_1 a^{n-1} b^1 + {}_nC_2 a^{n-2} b^2 + \cdots + {}_nC_r a^{n-r} b^r + \cdots + {}_nC_n a^0 b^n$		
Permutations:	${}_nP_r = \frac{n!}{(n-r)!}$	Combinations:	${}_nC_r = \frac{n!}{(n-r)!r!}$

Projectile Motion

Vertical Position:	$y = tv_0 \sin\theta - \frac{1}{2}gt^2 + h_0$	Horizontal Distance:	$x = tv_0 \cos\theta$
Vertical Free-Fall Motion:	$s(t) = -\frac{1}{2}gt^2 + v_0 t + s_0$	$v(t) = -gt + v_0$	$g \approx 32\frac{ft}{\sec^2} \approx 9.8\frac{m}{\sec^2}$

Conic Sections

Circle:	Standard Form:	$(x-h)^2 + (y-k)^2 = r^2$	
Parabola:	Standard Form:	$(y-k)^2 = 4p(x-h)$	$(x-h)^2 = 4p(y-k)$
	Focus:	$(h+p, k)$	$(h, k+p)$
	Directrix:	$x = h - p$	$y = k - p$
Ellipse:	Standard Form:	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$
	Foci:	$(h \pm c, k)$	$(h, k \pm c)$
	a, b, c Relationship:	$c^2 = a^2 - b^2$	
Hyperbola:	Standard Form:	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$
	Foci:	$(h \pm c, k)$	$(h, k \pm c)$
	Asymptotes:	$(y-k) = \pm\frac{b}{a}(x-h)$	$(y-k) = \pm\frac{a}{b}(x-h)$
	a, b, c Relationship:	$c^2 = a^2 + b^2$	
Eccentricity:	$e = \frac{c}{a}$		

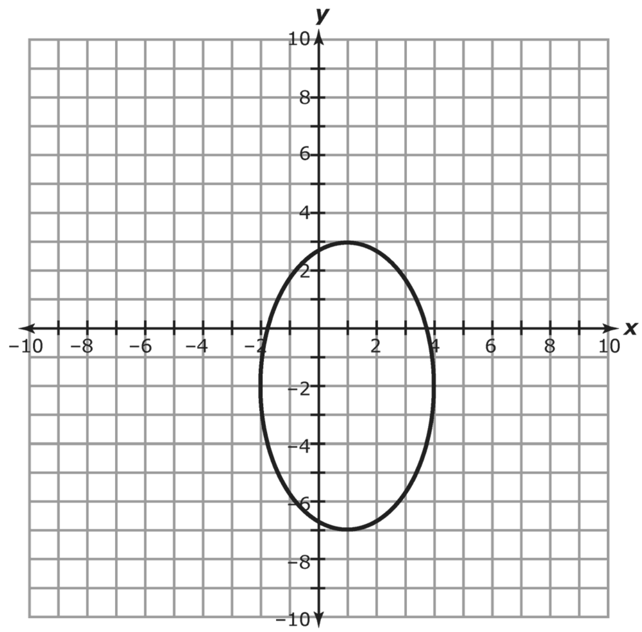
Exponential Functions

Simple Interest:	$I = prt$		
Compound Interest:	$A = P\left(1 + \frac{r}{n}\right)^{nt}$	Continuous Compound Interest:	$A = Pe^{rt}$
Exponential Growth or Decay:	$N = N_0(1+r)^t$	Continuous Exponential Growth or Decay:	$N = N_0e^{kt}$

Coordinate Geometry

Distance Formula:	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$		
Slope of a Line:	$m = \frac{y_2 - y_1}{x_2 - x_1}$		
Midpoint Formula:	$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$		
Quadratic Equation:	$ax^2 + bx + c = 0$	Quadratic Formula:	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Slope-Intercept Form of a Line:	$y = mx + b$		
Point-Slope Form of a Line:	$y - y_1 = m(x - x_1)$		
Standard Form of a Line:	$Ax + By = C$		

1 The graph of an ellipse is shown.



Which equation represents this ellipse?

A $\dfrac{(x-1)^2}{3}+\dfrac{(y+2)^2}{5}=1$

B $\dfrac{(x+1)^2}{3}+\dfrac{(y-2)^2}{5}=1$

C $\dfrac{(x-1)^2}{9}+\dfrac{(y+2)^2}{25}=1$

D $\dfrac{(x+1)^2}{9}+\dfrac{(y-2)^2}{25}=1$

2 Andrew kicks a soccer ball from the ground with an initial velocity of 35 meters per second at an angle of 8°. How far away from Andrew will the soccer ball land?

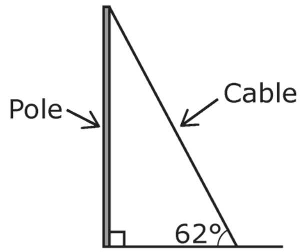
A 10.6 meters

B 17.2 meters

C 34.5 meters

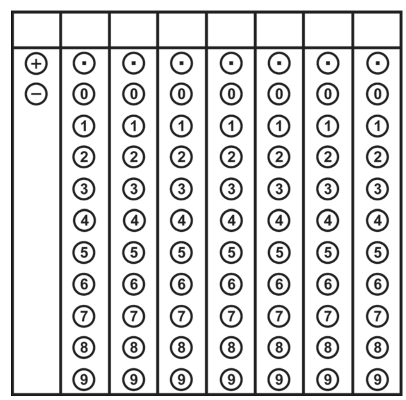
D 36.0 meters

3 A cable holds an 80-foot pole straight upright, as shown.



Based on the given information, what is the approximate length of the cable, to the nearest tenth of a foot?

Record the answer and fill in the bubbles on the grid provided. Be sure to use the correct place value.



4 What are the rectangular coordinates for the point $\left(5, \frac{5\pi}{6}\right)$?

A $\left(-\frac{5\sqrt{3}}{2}, \frac{5}{2}\right)$

B $\left(-\frac{5}{2}, \frac{5\sqrt{3}}{2}\right)$

C $\left(\frac{5}{2}, -\frac{5\sqrt{3}}{2}\right)$

D $\left(\frac{5\sqrt{3}}{2}, -\frac{5}{2}\right)$

5 What is the exact value of $\tan\left(\frac{-19\pi}{6}\right)$?

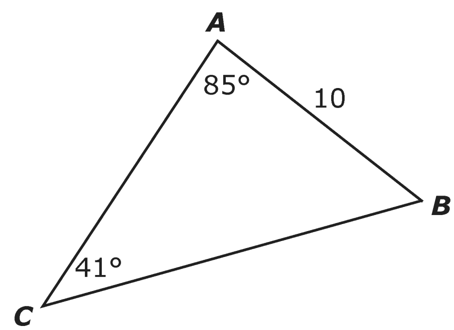
A $-\sqrt{3}$

B $-\frac{\sqrt{3}}{3}$

C $\frac{\sqrt{3}}{3}$

D $\sqrt{3}$

6 Triangle *ABC* is shown.



Based on the information in the diagram, what is the approximate length of $\overline{AC}$?

A 6.59

B 8.11

C 12.33

D 15.18

7 If $\cos\theta = \frac{5}{13}$ and $\sin\theta < 0$, what is $\cot\theta$?

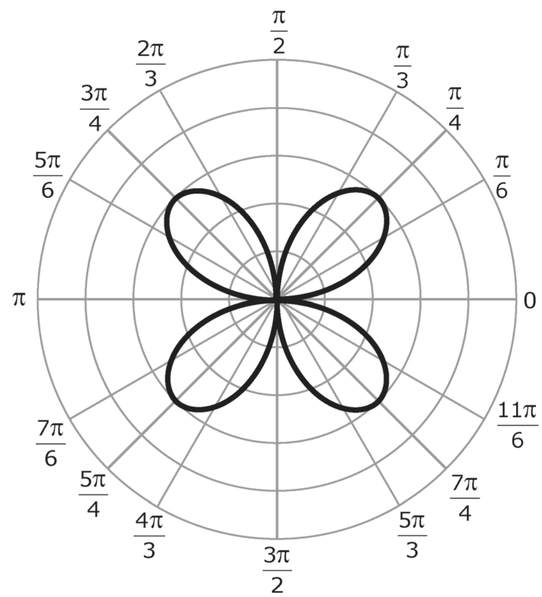
A $-\frac{12}{5}$

B $-\frac{5}{12}$

C $\frac{5}{12}$

D $\frac{12}{5}$

8 A polar equation is used to produce the graph of the rose shown.



Which equation is used to create the rose?

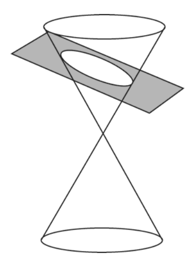
A $r = 2\sin(2\theta)$

B $r = 2\sin(4\theta)$

C $r = 3\sin(4\theta)$

D $r = 3\sin(2\theta)$

9 The intersection of a plane and a double-napped cone is shown in the diagram.



What type of conic section is formed by this intersection?

A Circle

B Ellipse

C Hyperbola

D Parabola

10 Alondra simplified the expression $\cot\theta\sec\theta\sin^2\theta$ using the steps shown.

Step 1: $\dfrac{\cos\theta}{\sin\theta} \cdot \sec\theta \cdot \sin^2\theta$

Step 2: $\dfrac{\cos\theta}{\sin\theta} \cdot \dfrac{1}{\sin\theta} \cdot \sin^2\theta$

Step 3: $\dfrac{\cos\theta}{\sin^2\theta} \cdot \sin^2\theta$

Step 4: $\cos\theta$

In which step, if any, did Alondra make her first mistake?

A Step 1

B Step 2

C Step 3

D Alondra did not make a mistake.

11 Which equation represents the hyperbola with foci at (−8, 3) and (4, 3) and a transverse axis that is 8 units long?

A $\dfrac{(x-2)^2}{16} - \dfrac{(y+3)^2}{36} = 1$

B $\dfrac{(x-2)^2}{36} - \dfrac{(y+3)^2}{16} = 1$

C $\dfrac{(x+2)^2}{20} - \dfrac{(y-3)^2}{16} = 1$

D $\dfrac{(x+2)^2}{16} - \dfrac{(y-3)^2}{20} = 1$

12 What is the exact value of the trigonometric function cos(−870°)?

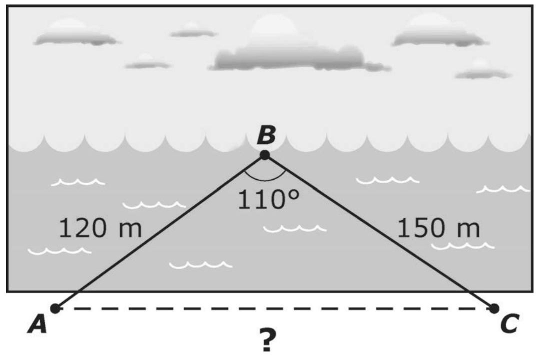
A $-\dfrac{\sqrt{3}}{2}$

B $-\dfrac{1}{2}$

C $\dfrac{1}{2}$

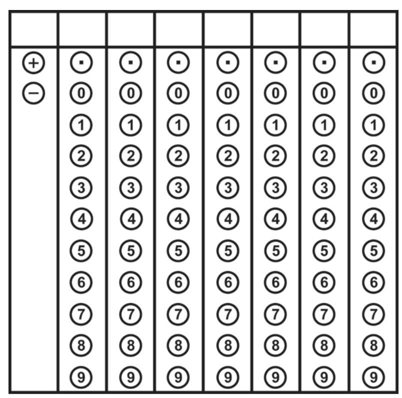
D $\dfrac{\sqrt{3}}{2}$

13 The diagram shows a boat that is anchored at point *B* in a river. There are two boat ramps on the far side of the river, shown by points *A* and *C*. The boat is 120 meters from ramp *A* and 150 meters from ramp *C*.



If $m\angle ABC = 110°$, what is the approximate distance between the two boat ramps, to the nearest meter?

Record the answer and fill in the bubbles on the grid provided. Be sure to use the correct place value.



14 What is the reference angle for an angle that measures $-\frac{17\pi}{4}$ radians?

A $\frac{7\pi}{4}$

B $\frac{5\pi}{4}$

C $\frac{3\pi}{4}$

D $\frac{\pi}{4}$

15 Which pair of parametric equations represents a line that passes through points (2, 1) and (0, −3)?

A $x = -2t$
$y = -4t + 3$

B $x = -2t$
$y = -8t + 3$

C $x = 2t$
$y = 4t - 3$

D $x = 2t$
$y = 8t - 3$

16 Harrison walks to the library after school every day. When Harrison leaves school, he walks 16 blocks due West and then 12 blocks due North to get to the library. What is the magnitude and direction of the resultant vector?

A Magnitude: 20 blocks
Direction: N 48.6° W

B Magnitude: 20 blocks
Direction: N 53.1° W

C Magnitude: 28 blocks
Direction: N 48.6° W

D Magnitude: 28 blocks
Direction: N 53.1° W

17 A hyperbola has foci at (−1, −2) and (13, −2) and an eccentricity of $\frac{7}{6}$. What is the equation of the hyperbola in standard form?

A $\frac{(x+6)^2}{36} - \frac{(y-2)^2}{85} = 1$

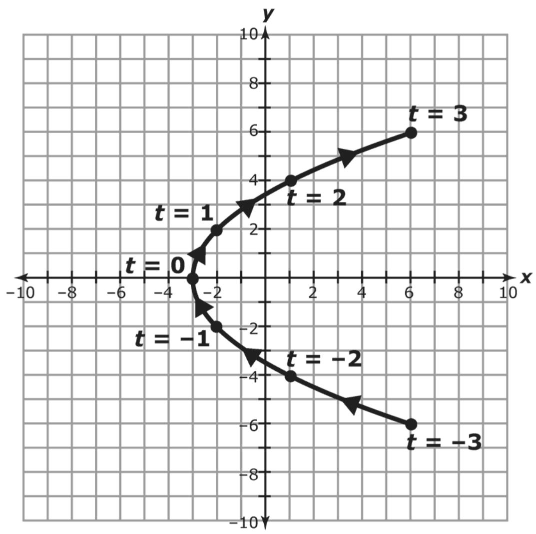
B $\frac{(x-6)^2}{36} - \frac{(y+2)^2}{85} = 1$

C $\frac{(x+6)^2}{36} - \frac{(y-2)^2}{13} = 1$

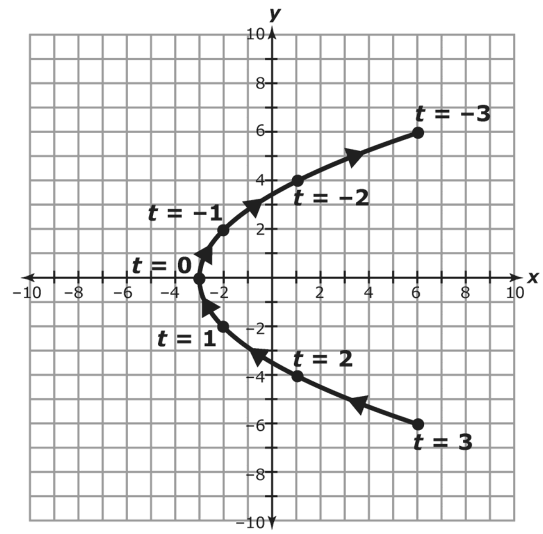
D $\frac{(x-6)^2}{36} - \frac{(y+2)^2}{13} = 1$

18 Which graph represents the curve given by the parametric equations $x = t^2 - 3$ and $y = 2t$ over the interval $-3 \le t \le 3$?

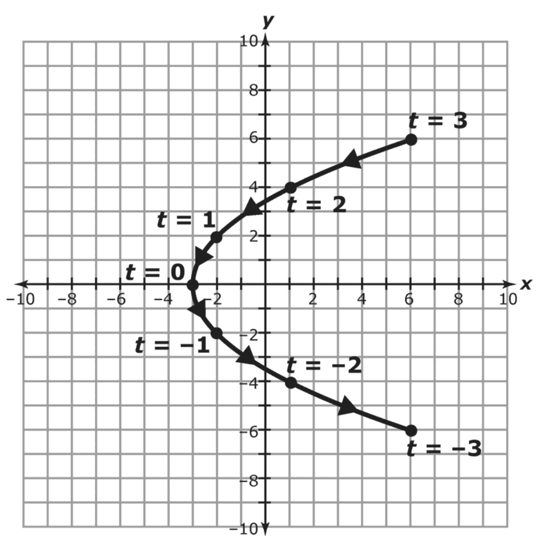
A



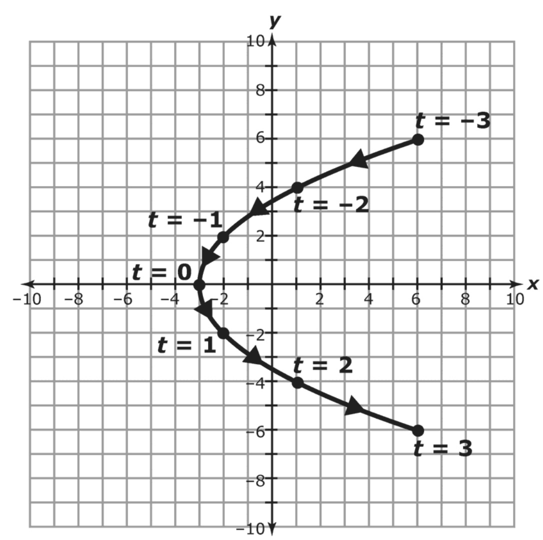
C



B



D



19 If **u** = ⟨8, 12, −3⟩, **v** = ⟨−4, 7, 14⟩, and **w** = ⟨2, −5, 6⟩, what is 3**u** − 4**v** + 2**w**?

A ⟨6, 14, 17⟩

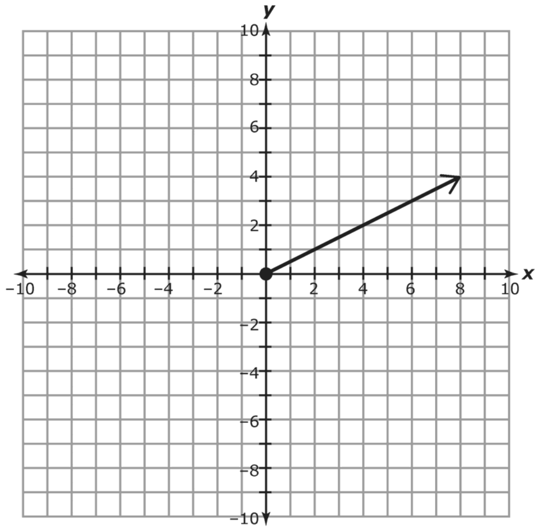
B ⟨19, 24, 23⟩

C ⟨12, 54, 9⟩

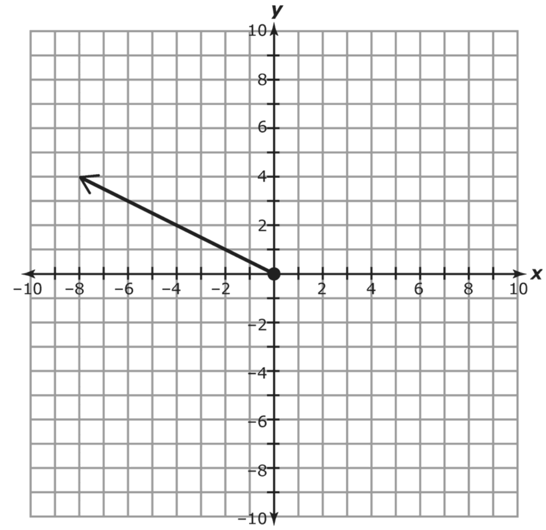
D ⟨44, −2, −53⟩

20 If **r** = ⟨4, −2⟩, which graph represents −2**r**?

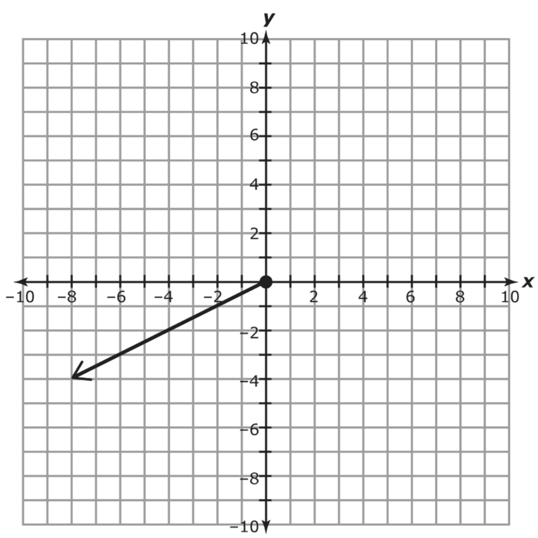
A



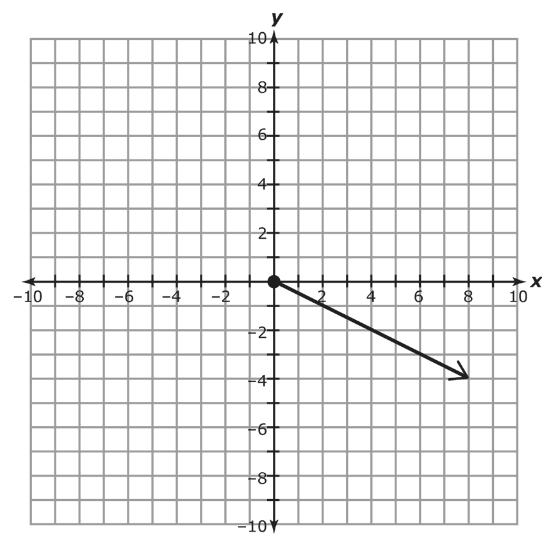
C



B



D



21 What is the reference angle for an angle that measures 300°?

A 30°

B 60°

C 120°

D 150°

22 What is the rectangular form for the curve given by the parametric equations $x = t + 6$ and $y = 5t - 3$?

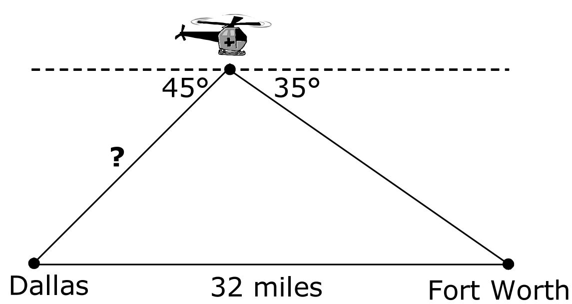
A $y = 5x - 33$

B $y = 5x + 3$

C $y = 5x + 27$

D $y = 5x - 9$

23 A helicopter is flying from downtown Dallas to downtown Fort Worth. The distance between the two cities is 32 miles.



If the angle of depression from the helicopter to Dallas is 45° and the angle of depression to Fort Worth is 35°, approximately how far is the helicopter from downtown Dallas?

A 18.6 miles

B 23.0 miles

C 26.0 miles

D 39.4 miles

EXAMPLE ITEMS Pre-Calculus Key, Sem 2

Item#	Key	SE	SE Justification
1	C	P.3H	Use the characteristics of an ellipse to write the equation of an ellipse with center (h, k).
2	C	P.3C	Use parametric equations to solve real-world problems.
3	90.6	P.4E	Solve problems involving trigonometric ratios in real-world problems.
4	A	P.3D	Convert between rectangular coordinates and polar coordinates.
5	B	P.4A	Determine the relationship between the unit circle and the definition of a periodic function to evaluate trigonometric functions in mathematical problems.
6	C	P.4G	Use the Law of Sines in mathematical problems.
7	B	P.4E	Determine the value of trigonometric ratios of angles.
8	D	P.3E	Graph polar equations by plotting points.
9	B	P.3F	Determine the conic section formed when a plane intersects a double-napped cone.
10	B	P.5M	Use trigonometric identities such as reciprocal and quotient to simplify trigonometric expressions.
11	D	P.3I	Use the characteristics of a hyperbola to write the equation of a hyperbola with center (h, k).
12	A	P.4A	Determine the relationship between the unit circle and the definition of a periodic function to evaluate trigonometric functions in mathematical problems.
13	222	P.4H	Use the Law of Cosines in real-world problems.
14	D	P.4C	Find the measure of reference angles and angles.
15	C	P.3C	Use parametric equations to model mathematical problems.
16	B	P.4I	Use vectors to model situations involving magnitude and direction.
17	D	P.3I	Use the characteristics of a hyperbola to write the equation of a hyperbola with center (h, k).
18	A	P.3A	Graph a set of parametric equations.
19	D	P.4K	Apply vector addition and multiplication of a vector by a scalar in mathematical problems.
20	C	P.4J	Represent the multiplication of a vector by a scalar geometrically.
21	B	P.4C	Find the measure of reference angles.
22	A	P.3B	Convert parametric equations into rectangular relations.
23	A	P.4G	Use the Law of Sines real-world problems.