Example Items

Pre-Calculus
Pre-AP

Pre-Calculus Pre-AP 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 (assessment.dallasisd.org).

OR

(2) To submit directly: Login to the Assessment website. Under "News" in the left-hand column, click on "Sem 2 Example Items Download." Above the subjects, click on "Example Feedback Form."

Second Semester
2017–2018
Code #: 1221

$\mathcal{ACP}$ Formulas
Pre-Calculus/Pre-Calculus PAP
2017–2018

Trigonometric Functions and Identities			
Pythagorean Theorem:		$a^2 + b^2 = c^2$	
Special Right Triangles:		30° - 60° - 90° 45° - 45° - 90°	$x, x\sqrt{3}, 2x$ $x, x, x\sqrt{2}$
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 Speed:	$v = \frac{s}{t}$	Angular Speed:	$\omega = \frac{\theta}{t}$
Reciprocal Identities:	$\sin\theta = \frac{1}{\csc\theta}$ $\csc\theta = \frac{1}{\sin\theta}$	$\cos\theta = \frac{1}{\sec\theta}$ $\sec\theta = \frac{1}{\cos\theta}$	$\tan\theta = \frac{1}{\cot\theta}$ $\cot\theta = \frac{1}{\tan\theta}$
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:	$\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$ $\cos(\alpha-\beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$	$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$ $\sin(\alpha-\beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$	
Double-Angle Identities:	$\sin 2x = 2\sin x\cos x$ $\cos 2x = 2\cos^2 x - 1$	$\cos 2x = \cos^2 x - \sin^2 x$ $\cos 2x = 1 - 2\sin^2 x$	

Projectile Motion			
Vertical Position:	$y = -\frac{1}{2}gt^2 + (v_0 \sin\theta)t + y_0$	Horizontal Distance:	$x = (v_0 \cos\theta)t$
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		
Parabola:	$(x - h)^2 = 4p(y - k)$	$(y - k)^2 = 4p(x - h)$
Circle:	$x^2 + y^2 = r^2$	$(x - h)^2 + (y - k)^2 = r^2$
Ellipse:	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$
Hyperbola:	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$

$\mathcal{ACP}$ Formulas
Pre-Calculus/Pre-Calculus PAP
2017–2018

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:	$N = N_0e^{kt}$

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:	$a_n = a_1r^{n-1}$
Sum of a Finite Arithmetic Series:	$\sum_{k=1}^{n} a_k = \frac{n}{2}(a_1 + a_n)$		
Sum of a Finite Geometric Series:	$\sum_{k=1}^{n} a_k = \frac{a_1(1-r^n)}{1-r},\ \lvert r\rvert \neq 1$		$S_n = \frac{a_1 - a_nr}{1-r},\ \lvert r\rvert \neq 1$
Sum of an Infinite Geometric Series:	$\sum_{n=1}^{\infty} a_n = \frac{a_1}{1-r},\ \lvert r\rvert \neq 1$		
Binomial Theorem:	$(a+b)^n = {}_nC_0a^nb^0 + {}_nC_1a^{n-1}b^1 + {}_nC_2a^{n-2}b^2 + \cdots + {}_nC_na^0b^n$		
Permutations:	${}_nP_r = \frac{n!}{(n-r)!}$	Combinations:	${}_nC_r = \frac{n!}{(n-r)!r!}$

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:		$Ax + By = C$	

HIGH SCHOOL

EXAMPLE ITEMS Pre-Calculus Pre-AP, Sem 2

1 A hyperbola has vertices at (2, −5) and (2, 3). The slope of one asymptote is $-\frac{1}{2}$. What is the equation of the hyperbola?

A $\frac{(y-1)^2}{16} - \frac{(x+2)^2}{64} = 1$

B $\frac{(y+1)^2}{16} - \frac{(x-2)^2}{64} = 1$

C $\frac{(x+2)^2}{16} - \frac{(y-1)^2}{8} = 1$

D $\frac{(x-2)^2}{16} - \frac{(y+1)^2}{8} = 1$

2 An ellipse centered at the origin has a vertical major axis of 12 units and an eccentricity of 0.5. What is the equation of the ellipse?

A $\frac{x^2}{36} + \frac{y^2}{144} = 1$

B $\frac{x^2}{108} + \frac{y^2}{144} = 1$

C $\frac{x^2}{9} + \frac{y^2}{36} = 1$

D $\frac{x^2}{27} + \frac{y^2}{36} = 1$

3 What are the polar coordinates of the point (2, −2)?

A $\left(4\sqrt{2}, \frac{7\pi}{4}\right)$

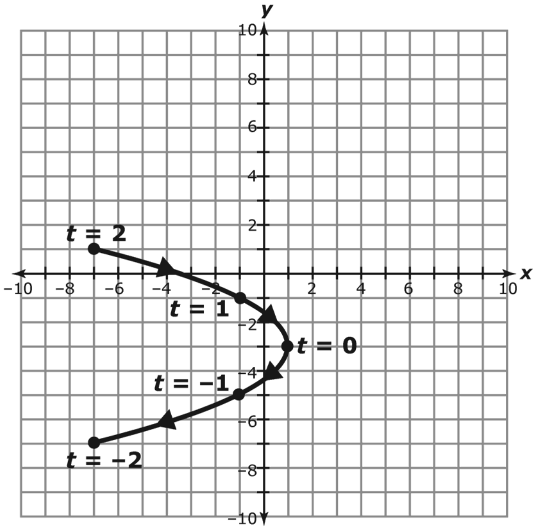
B $\left(4\sqrt{2}, \frac{3\pi}{4}\right)$

C $\left(2\sqrt{2}, \frac{7\pi}{4}\right)$

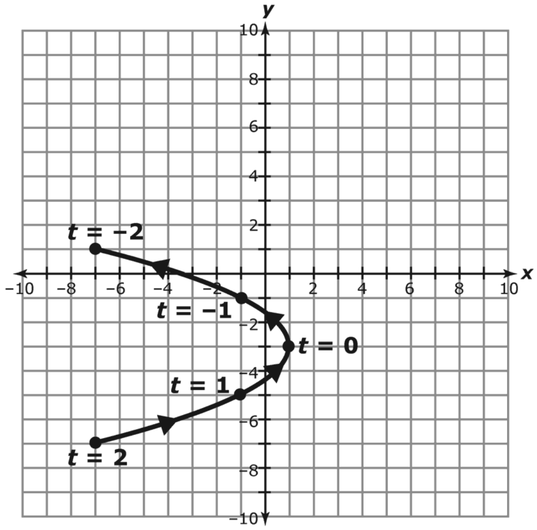
D $\left(2\sqrt{2}, \frac{3\pi}{4}\right)$

4 Which graph represents the curve given by the parametric equations $x = -2t^2 + 1$ and $y = 2t - 3$ over the interval $-2 \le t \le 2$?

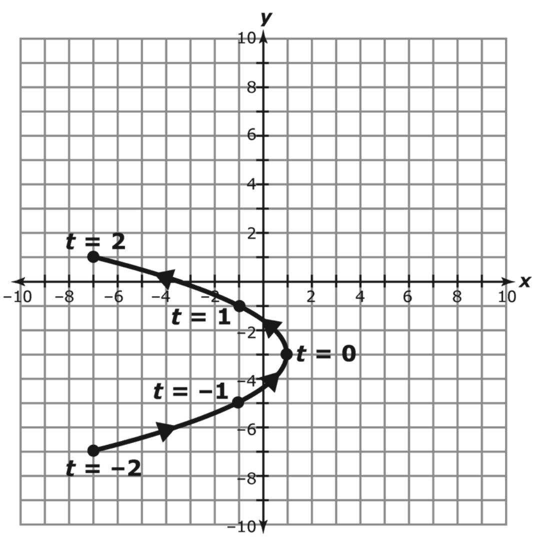
A



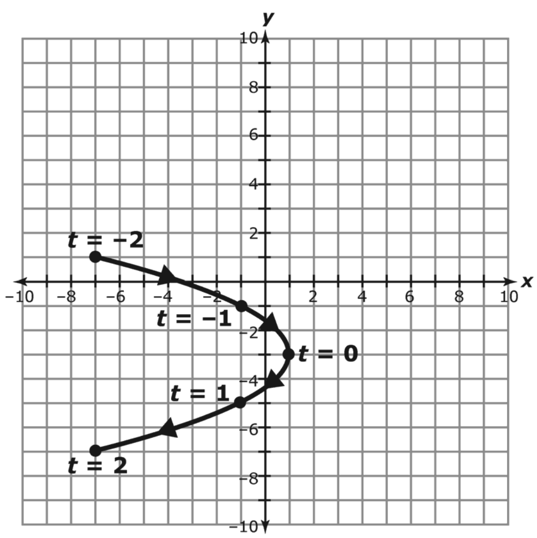
C



B



D



5 If a plane intersects a double-napped cone parallel to the slant height of the cone, what type of conic section is formed?

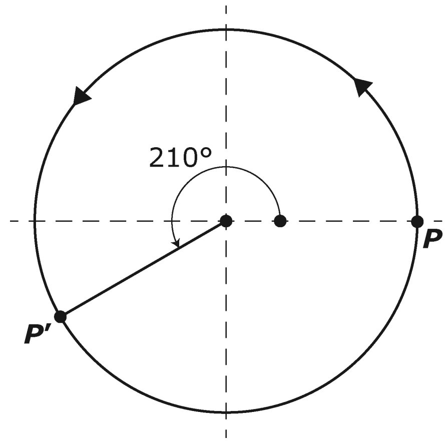
A Parabola

B Circle

C Ellipse

D Hyperbola

6 Point P is rotated 210° counterclockwise around a circle with a diameter of 20 meters.



If the center of the circle is at the origin, which coordinates represent the location of P′ relative to the center?

A $(-5\sqrt{3}, -5)$

B $(-10\sqrt{3}, -10)$

C $(-10, -10\sqrt{3})$

D $(-5, -5\sqrt{3})$

7 What is the rectangular form for the curve given by the parametric equations $x = t^2 + 5t - 1$ and $y = t + 1$?

A $x = y^2 - 5y + 3$

B $x = y^2 + 5y - 3$

C $x = y^2 - 3y + 5$

D $x = y^2 + 3y - 5$

8 If $\mathbf{a} = \langle -6, 12, -9 \rangle$, $\mathbf{b} = \langle 2, -16, 18 \rangle$, and $\mathbf{c} = \langle 28, -14, 3 \rangle$, what is $\frac{1}{3}\mathbf{a} - \frac{3}{2}\mathbf{b} + 2\mathbf{c}$?

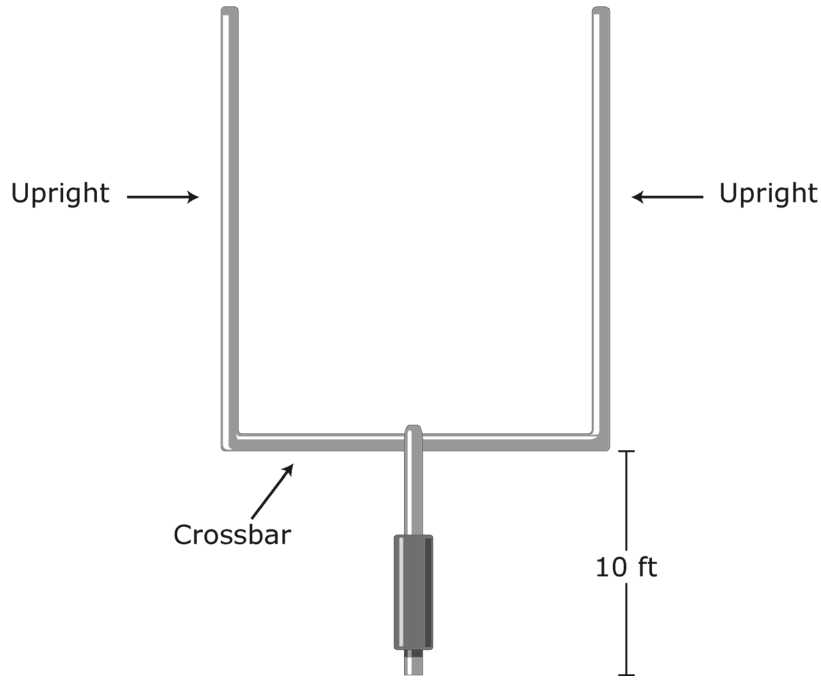
A $\langle 51, 0, -24 \rangle$

B $\langle 57, -48, 30 \rangle$

C $\langle 24, -18, 12 \rangle$

D $\langle 20, 14, -24 \rangle$

9 A kicker in a football game attempts a field goal 50 yards from the goal post. The ball is on the ground and is kicked with an initial velocity of 81 ft/sec at an angle of 66°. The height of the crossbar on the goal post is 10 feet, as shown in the diagram.



For the field goal to be good, the ball must pass over the crossbar and between the uprights. Assuming the kick is straight and passes between the uprights, which conclusion is true?

A The ball hits the ground before reaching the goal post, so the field goal is no good.

B The ball passes under the crossbar, so the field goal is no good.

C The ball passes over the crossbar, so the field goal is good.

D The ball hits the crossbar, so it cannot be determined if the field goal is good.

10 What is the exact value of $\tan\left(-\frac{14\pi}{3}\right)$, if it exists?

A $-\sqrt{3}$

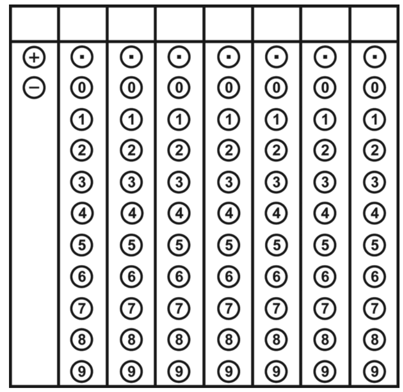
B $\frac{\sqrt{3}}{3}$

C $\sqrt{3}$

D Undefined

11 In ΔABC, $m\angle A = 32°$, $m\angle C = 110°$ and side $c = 750$. What is the approximate length, to the nearest hundredth, of side a?

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



12 An airplane flies east for 200 miles before turning 60º south and flying for 100 miles. What are the magnitude and the direction of the airplane from its starting point?

A Magnitude: 173.2 miles
Direction: E 19.1° S

B Magnitude: 264.6 miles
Direction: E 19.1° S

C Magnitude: 173.2 miles
Direction: E 30° S

D Magnitude: 264.6 miles
Direction: E 30° S

13 Which angle has a negative sine value and a negative cotangent value?

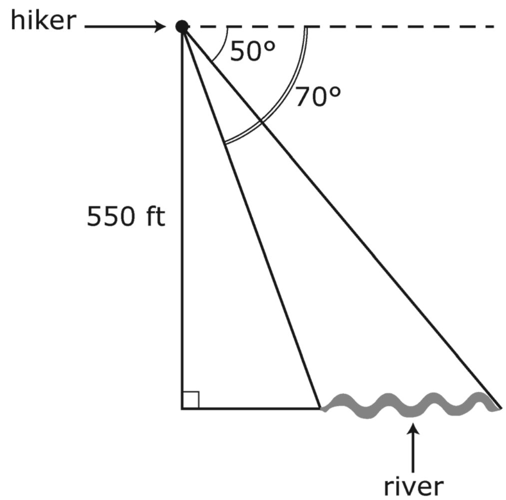
A $\frac{\pi}{7}$

B $\frac{5\pi}{8}$

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

D $\frac{9\pi}{5}$

14 From the top of a 550-foot cliff, a hiker looks down at a river below. Her angles of depression to the near and far banks of the river are 70° and 50° respectively, as shown in the picture.



Based on this information, approximately how wide is the river?

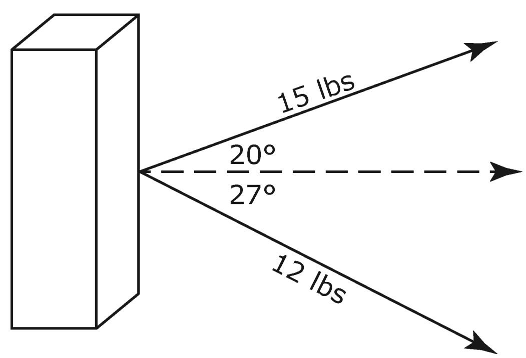
A 61.1 feet

B 200.2 feet

C 261.3 feet

D 461.5 feet

15 Two forces act upon an object as shown.



What is the approximate magnitude of the resultant force?

A 22.2 pounds

B 24.8 pounds

C 30.9 pounds

D 48.2 pounds

16 The co-vertices of an ellipse are at (−2, 1) and (8, 1) and the eccentricity is $\frac{12}{13}$. What is the equation of this ellipse?

A $\frac{(x-3)^2}{169}+\frac{(y-1)^2}{25}=1$

B $\frac{(x+3)^2}{25}+\frac{(y+1)^2}{169}=1$

C $\frac{(x-3)^2}{25}+\frac{(y-1)^2}{169}=1$

D $\frac{(x+3)^2}{169}+\frac{(y+1)^2}{25}=1$

17 During a scouting exercise, Andres leaves camp and hikes 2 miles northwest. He then turns and hikes 3 miles due north. Felicia leaves camp and plans to hike on a direct path to Andres' new position. What are the direction and distance Felicia should hike?

A Direction: 107.7°
Distance: 3.6 miles

B Direction: 287.7°
Distance: 3.6 miles

C Direction: 287.7°
Distance: 4.6 miles

D Direction: 107.7°
Distance: 4.6 miles

18 If $\cos\theta = \frac{7}{25}$ and $\tan\theta < 0$, what is the value of $\csc\theta$?

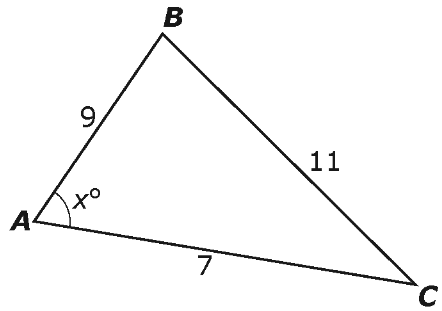
A $-\frac{25}{24}$

B $-\frac{24}{25}$

C $\frac{24}{25}$

D $\frac{25}{24}$

19 Julissa wants to find the measure of $\angle A$ in $\Delta\, ABC$.



She uses the Law of Cosines to work the problem as shown.

Step 1: $11^2 = 7^2 + 9^2 - 2 \cdot 9 \cdot 7 \cdot \cos x$

Step 2: $121 = 130 - 126 \cos x$

Step 3: $9 = -126 \cdot \cos x$

Step 4: $-\dfrac{9}{126} = \cos x$

Step 5: $x = \cos^{-1}\left(-\dfrac{9}{126}\right) \approx 94^\circ$

In which step did Julissa make a mistake?

A Step 1

B Step 2

C Step 3

D Step 4

20 Which polar equation produces a Spiral of Archimedes?

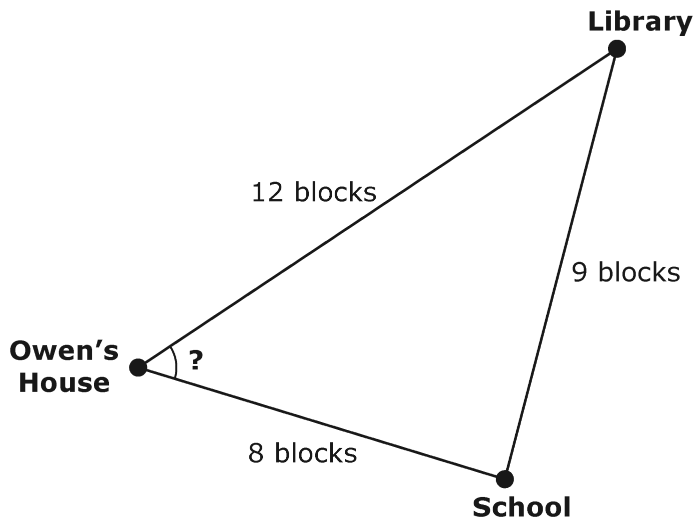
A $\theta = \dfrac{2\pi}{3}$

B $r \cos\theta = 2$

C $r \sin\theta = 2$

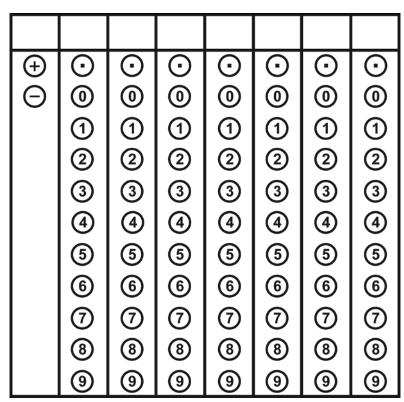
D $r = 2\theta$

21 Owen's house is 12 blocks from the library and 8 blocks from the school. The library is 9 blocks from the school.



What is the approximate measure, to the nearest degree, of the angle between the path from Owen's house to the library and the path from Owen's house to the school?

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



EXAMPLE ITEMS Pre-Calculus Pre-AP Key, Sem 2

Item#	Key	SE	SE Justification
1	B	P.3I	Use the characteristics of a hyperbola to write the equation of a hyperbola with center (h, k).
2	D	P.3H	Use the characteristics of an ellipse to write the equation of an ellipse with center (h, k).
3	C	P.3D	Convert between rectangular coordinates and polar coordinates.
4	B	P.3A	Graph a set of parametric equations.
5	A	P.3F	Determine the conic section formed when a plane intersects a double-napped cone.
6	A	P.4A	Determine the relationship between the unit circle and the definition of a periodic function to evaluate trigonometric functions in mathematical problems.
7	D	P.3B	Convert parametric equations into rectangular relations.
8	A	P.4J	Represent the addition of vectors and the multiplication of a vector by a scalar symbolically.
9	B	P.3C	Use parametric equations to solve real-world problems.
10	C	P.4A	Determine the relationship between the unit circle and the definition of a periodic function to evaluate trigonometric functions in mathematical problems.
11	422.95	P.4G	Use the Law of Sines in mathematical problems.
12	B	P.4I	Use vectors to model situations involving magnitude and direction.
13	D	P.4C	Represent angles in degrees based on the concept of rotation.
14	C	P.4E	Solve problems involving trigonometric ratios in real-world problems.
15	B	P.4K	Apply vector addition in real-world problems.
16	C	P.3H	Use the characteristics of an ellipse to write the equation of an ellipse with center (h, k).
17	D	P.4K	Apply vector addition and multiplication of a vector by a scalar in real-world problems.
18	A	P.4E	Determine the value of trigonometric ratios of angles.
19	C	P.4H	Use the Law of Cosines in mathematical problems.
20	D	P.3E	Graph polar equations by plotting points and using technology.
21	49	P.4H	Use the Law of Cosines in real-world problems.