1 Two ships leave port at 10:00 AM. Ship A travels at a bearing of N 30° E at 20 mph and ship B travels at a bearing of S 15° E. If the two ships are 85 miles apart at noon, how fast is ship B traveling?

a. 51.9 mph

b. 45.3 mph

c. 21.7 mph

d. 25.6 mph

e. 19.4 mph

f. 25.9 mph

2 For the function $f(x) = x^2(x + a)(x - 5)^3$, where $a > 0$, find all values of x such that $f(x) > 0$.

a. $(5, \infty)$

b. $(-a, 5)$

c. $(-\infty, -a) \cup (5, \infty)$

d. $(-\infty, -5) \cup (a, \infty)$

e. $(-5, a)$

f. $(-\infty, 0) \cup (a, \infty)$

3 A boy is flying two kites at the same time. He has 420 ft of line out to one kite and 350 ft out to the other. He estimates the angle between the two lines to be 58°. Approximate the distance between the kites.

a. 547 feet

b. 223 feet

c. 0 feet

d. 483 feet

e. 470 feet

f. 378 feet

4 The graph of which of the following functions has a vertical asymptote at $x = 7$, a hole at $x = -4$, and a horizontal asymptote at $y = 0$?

a. $f(x) = \dfrac{x - 4}{x + 7}$

b. $f(x) = \dfrac{(x + 4)^2}{x^2 - 3x - 28}$

c. $f(x) = \dfrac{x + 4}{(x - 7)^2}$

d. $f(x) = \dfrac{x + 4}{x^2 - 3x - 28}$

e. $f(x) = \dfrac{x + 4}{x - 7}$

f. $f(x) = \dfrac{x - 4}{x^2 + 3x - 28}$

5 Find the exact solutions of the equation $\cos(2t) = 9\cos t - 1$ that are in the interval $[0, 2\pi)$.

6 Find the equations of the asymptotes for the hyperbola.

$$\frac{(x - 9)^2}{9} - \frac{y^2}{49} = 1$$

a. $y = \pm\dfrac{3}{7}x$

b. $y = \pm\dfrac{9}{49}(x - 9)$

c. $y = \pm\dfrac{3}{7}(x - 9)$

d. $y = \pm\dfrac{49}{9}(x - 9)$

e. $y = \pm\dfrac{7}{3}(x - 9)$

f. $y = \pm\dfrac{7}{3}x$

7 Find the area of triangle *ABC* given $\alpha = 41^\circ$, $b = 9$, and $c = 12$.

a. 35.4 sq units

b. 70.9 sq units

c. 54 sq units

d. 31.2 sq units

e. 40.8 sq units

f. 46.9 sq units

8 Write the expression $\sin\left[2\cos^{-1}\left(\frac{8}{x}\right)\right]$ as an algebraic expression in x for $x > 0$.

a. $\frac{16(x-8)}{x^2}$

b. $\frac{\sqrt{x^2-64}}{x}$

c. $\frac{16\sqrt{x^2-64}}{x^2}$

d. $\frac{16\sqrt{x^2+64}}{x^2}$

e. $\frac{2\sqrt{x^2-64}}{x}$

f. $\frac{2\sqrt{x^2+64}}{x}$

9 Find the exact value of $\sin x$, if $\sec x = -5$ and tan x < 0.

a. $-\frac{1}{\sqrt{24}}$

b. $\frac{5}{\sqrt{24}}$

c. $-\frac{\sqrt{24}}{5}$

d. $-\frac{\sqrt{26}}{5}$

e. $\frac{\sqrt{26}}{5}$

f. $\frac{\sqrt{24}}{5}$

10 A 52-meter wire is stretched from the top of a 42 meter building to a point on level ground. From the top of the building, find the angle of depression to the point.

a. 36.13°

b. 53.87°

c. 51.07°

d. 40.72°

e. 49.28°

f. 38.93°

11 The graph of the conic equation $16x^2 + 49y^2 + 192x = 208$ has which of the following characteristics?

a. vertices: $(-1, 0)$, $(13, 0)$

foci: $\left(6 \pm \sqrt{65}, 0\right)$

b. vertices: $(-7, 0)$, $(7, 0)$

foci: $\left(\pm \sqrt{33}, 0\right)$

c. vertices: $(-7, 0)$, $(7, 0)$

foci: $\left(\pm \sqrt{65}, 0\right)$

d. vertices: $(-13, 0)$, $(1, 0)$

foci: $\left(-6 \pm \sqrt{65}, 0\right)$

e. vertices: $(-1, 0)$, $(13, 0)$

foci: $\left(6 \pm \sqrt{33}, 0\right)$

f. vertices: $(-13, 0)$, $(1, 0)$

foci: $\left(-6 \pm \sqrt{33}, 0\right)$

12 For the function $f(x) = \begin{cases} \sqrt{-x} & \text{for } x \leq 0 \\ \frac{9}{x} & \text{for } x > 0 \end{cases}$, as $x \to 0^+$, $f(x) \to$ _____ ?

a. ∞

b. 9

c. $-\infty$

d. $f(x)$ does not approach any value as $x \to 0^+$.

e. 1

f. 0

13 Which of the following angles is coterminal with $\theta = -\frac{2\pi}{3}$? All angles are in standard position.

a. -150°

b. -60°

c. 120°

d. 210°

e. -420°

f. 240°

14 Find the exact value of $\sin\left[\arctan\left(-\frac{2}{5}\right)+\frac{5\pi}{6}\right]$.

15 Convert the rectangular equation to a polar equation. $y^2 = 2x$

a. $r = 2\cos\theta\sin^2\theta$

b. $r = 2\cos\theta\sec^2\theta$

c. $r = 2\tan\theta\csc\theta$

d. $r = 2\tan\theta\sec\theta$

e. $r = 2\cot\theta\sec\theta$

f. $r = 2\cot\theta\csc\theta$

16 Which of the following is equivalent to $\sin(-x) - \cos(-x)\cot(x)$?

a. $-\sec x$

b. $-\csc x$

c. $\sec x$

d. $\tan x$

e. $\csc x$

f. $-\tan x$

17 The volume V of a right circular cylinder of radius r and height h is $V = \pi r^2 h$; the surface area S of this cylinder is $S = 2\pi r^2 + 2\pi rh$. If the volume of this cylinder is 4π cubic meters, express the sufrace area S as a function of the radius r.

a. $S(r) = \pi r\left(2 - r^2\right)$

b. $S(r) = \dfrac{2 - r^2}{r}$

c. $S(r) = 2\pi r^2 + \dfrac{8\pi}{r}$

d. $S(r) = \dfrac{4}{r^2}$

e. $S(r) = 2\pi r^2 + 2\pi rh$

f. $S(r) = \pi r^2 + \dfrac{4\pi}{r}$

18 If the area of a sector is 8 feet squared, find the radius of the sector if the central angle is $17°51'$.

a. 7.17 feet

b. 20.27 feet

c. 7.24 feet

d. 52.35 feet

e. 0.95 feet

f. 51.36 feet

19 For each parametric equation, find a rectangular-coordinate equation for the curve by eliminating the parameter. Match each parametric equation in the left column with the corresponding rectangular-coordinate equation in the right column.

$x = 6\sin t,\ y = 4\cos t$	$3(y+5)^2 = x - 1$
$x = 9t^2 + 1,\ y = 3t - 5$	$\dfrac{x^2}{16} + \dfrac{y^2}{36} = 1$
	$(y+5)^2 = x - 1$
	$\dfrac{x^2}{36} + \dfrac{y^2}{16} = 1$

20 The graph of which of the following equations has a period of 9π and a phase shift of 6 ?

a. $y = 2\tan\left(\frac{x}{9} + 6\right)$

b. $y = -2\tan\left(\frac{x}{9} - \frac{6}{9}\right)$

c. $y = 2\sin(9\pi x + 6)$

d. $y = -2\cos\left(\frac{2x}{9} + \frac{12}{9}\right)$

e. $y = -2\sin\left(\frac{x}{9} - \frac{12}{9}\right)$

f. $y = 2\cos(9\pi x - 6)$

21 Given the indicated parts of triangle *ABC* with $\gamma = 90^\circ$, approximate the value of the perimeter of the triangle to the nearest cm.

$\alpha = 56^\circ$, b = 30 cm

a. 61 cm

b. 98 cm

c. 128 cm

d. 109 cm

e. 99 cm

f. 91 cm

22 Simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$, if $h \neq 0$, for $f(x) = \frac{6}{x}$.

a. $\frac{f(x+h) - f(x)}{h} = \frac{6}{x(x+h)}$

b. $\frac{f(x+h) - f(x)}{h} = \frac{1}{x(x+h)}$

c. $\frac{f(x+h) - f(x)}{h} = 1$

d. $\frac{f(x+h) - f(x)}{h} = \frac{-6}{x(x+h)}$

e. $\frac{f(x+h) - f(x)}{h} = \frac{-1}{x(x+h)}$

f. $\frac{f(x+h) - f(x)}{h} = \frac{-6}{x^2}$

23 Find **ALL** the solutions of the equation $2\sin\left(2\theta - \frac{\pi}{5}\right) = \sqrt{3}$. Let *n* be an arbitrary integer.

a. $\theta = \frac{8\pi}{15} + 2\pi n,\ \theta = \frac{13\pi}{15} + 2\pi n$

b. $\theta = \frac{11\pi}{60} + \pi n, \theta = \frac{61\pi}{60} + \pi n$

c. $\theta = \frac{\pi}{3} + 2\pi n, \theta = \frac{2\pi}{3} + 2\pi n$

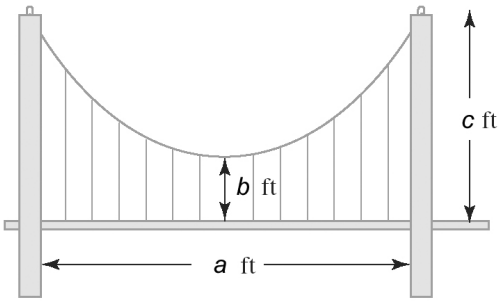
d. $\theta = \frac{4\pi}{15} + \pi n, \theta = \frac{13\pi}{30} + \pi n$

e. $\theta = \frac{25\pi}{28} + \pi n, \theta = \frac{39\pi}{28} + \pi n$

f. $\theta = \frac{11\pi}{60} + \pi n, \theta = \frac{31\pi}{60} + \pi n$

24 Approximate, to the nearest 0.01 radian, all angles θ in the interval $[0, 2\pi)$ that satisfy the equation $\csc\theta = -6.5$.

25 The cable of a suspension bridge is in the shape of a parabola. The cable extends over $a = 200$ feet of highway. The longest supporting wire, on either end of the cable, is $c = 100$ feet; the shortest, in the middle, is $b = 40$ feet. Find the length of the supporting wire that is 40 feet from the longest supporting wire. (See the figure.)



a. 530 feet

b. 61.6 feet

c. 21.6 feet

d. 76 feet

e. 520 feet

f. 29.6 feet

ANSWER KEY

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1. f **2.** c **3.** f **4.** d **5.** $\frac{\pi}{2}, \frac{3\pi}{2}$

6. e **7.** a **8.** c **9.** f **10.** b

11. f **12.** a **13.** f **14.** $\frac{2\sqrt{3}+5}{2\sqrt{29}}$ **15.** f

16. b **17.** c **18.** a **19.** $x = 6\sin t,\ y = 4\cos t \rightarrow \frac{x^2}{36} + \frac{y^2}{16} = 1$ **20.** b

21. c **22.** d **23.** d **24.** 3.3,6.13 **25.** b

$x = 9t^2 + 1,\ y = 3t - 5 \rightarrow (y+5)^2 = x - 1$