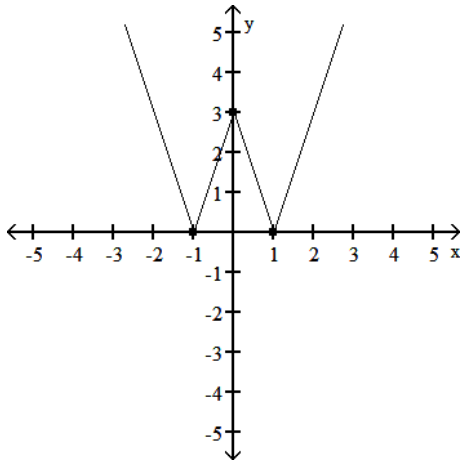
# Precalculus: Semester 1 Final Exam Review

The graph of a function f is given. Use the graph to answer the question.

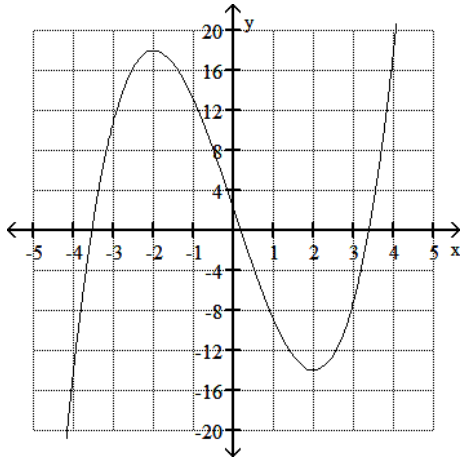
1) Find the numbers, if any, at which f has a relative maximum. What are the relative maxima?




A) f has a relative maximum at x = 1; the relative maximum is 3
B) f has a relative maximum at x = 0; the relative maximum is 3
C) f has a relative maximum at x = -1 and 1; the relative maximum is 0
D) f has no relative maximum

Use the graph of the given function to find any relative maxima and relative minima.

2) $f(x) = x^3 - 12x + 2$




A) minimum: (2, -14); maximum: (-2, 18)
B) maximum: (-2, 18) and (0, 0); minimum: (2, -14)
C) no maximum or minimum
D) maximum: (2, -14); minimum: (-2, 18)

Determine whether the given quadratic function has a minimum value or maximum value. Then find the coordinates of the minimum or maximum point.

3) $f(x) = x^2 - 2x - 8$

A) maximum; $(1, -9)$
B) minimum; $(1, -9)$
C) maximum; $(-9, 1)$
D) minimum; $(-9, 1)$

Find the coordinates of the vertex for the parabola defined by the given quadratic function.

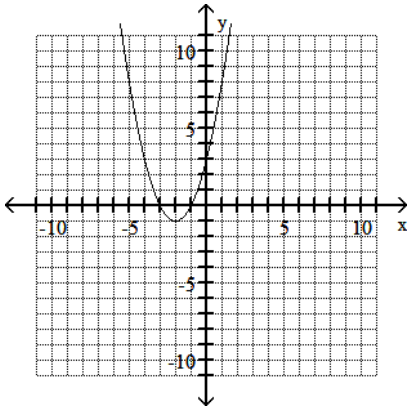
4) $f(x) = -x^2 - 14x - 1$

A) (7, -50)
B) (-14, -1)
C) (-7, 48)
D) (7, -148)

Use the vertex and intercepts to sketch the graph of the quadratic function.

5) $y + 1 = (x + 2)^2$

A)

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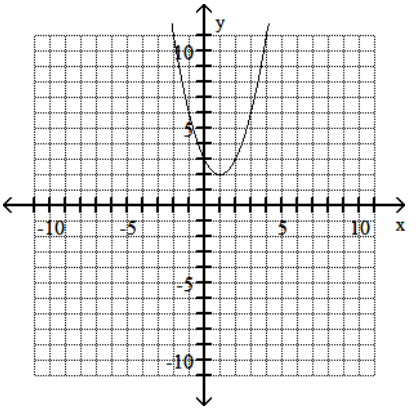


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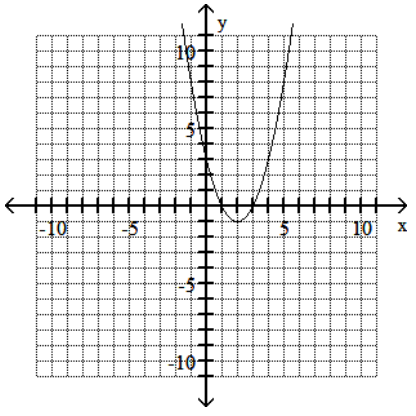


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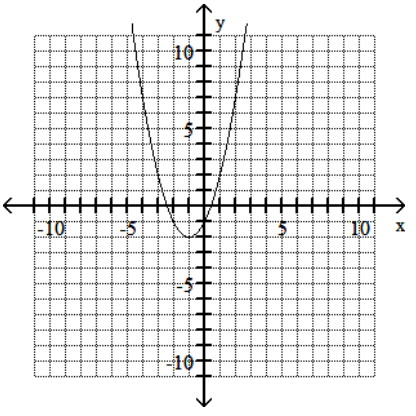



Use the Leading Coefficient Test to determine the end behavior of the polynomial function.

6) $f(x) = x^3 + 4x^2 + 3x - 3$

A) rises to the left and rises to the right

B) falls to the left and falls to the right

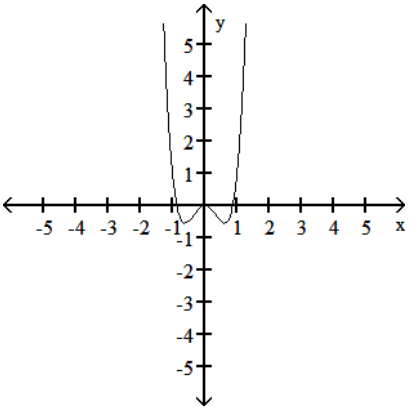
C) rises to the left and falls to the right

D) falls to the left and rises to the right

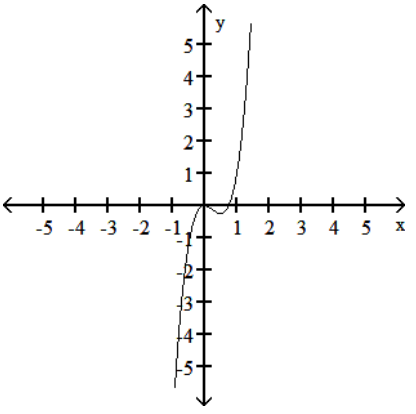
Use the Leading Coefficient Test to determine the end behavior of the polynomial function. Then use this end behavior to match the function with its graph.

7) $f(x) = 4x^4 - 3x^2$

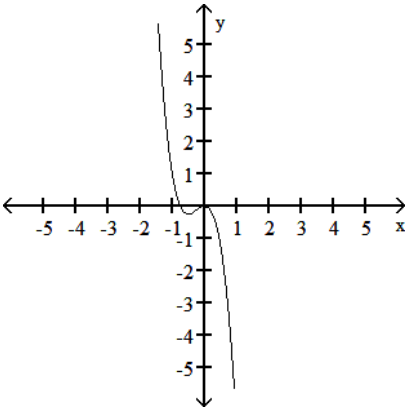
A) rises to the left and rises to the right



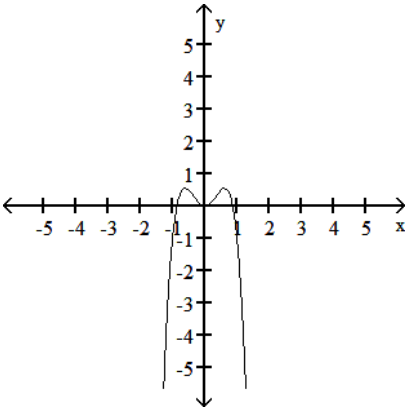

B) falls to the left and rises to the right




C) rises to the left and falls to the right




D) falls to the left and falls to the right




Find the zeros of the polynomial function.

8) $f(x) = x^3 + 6x^2 - x - 6$

A) $x = -6, x = 6$

B) $x = 1, x = -6, x = 6$

C) $x = -1, x = 1, x = -6$

D) $x = 36$

Find the zeros for the polynomial function and give the multiplicity for each zero. State whether the graph crosses the x-axis or touches the x-axis and turns around, at each zero.

9) $f(x) = 5(x - 7)(x + 3)^2$

A) 7, multiplicity 1, crosses x-axis; -3, multiplicity 2, touches x-axis and turns around

B) -7, multiplicity 1, touches x-axis and turns around; 3, multiplicity 2, crosses x-axis

C) 7, multiplicity 1, touches x-axis and turns around; -3, multiplicity 2, crosses x-axis

D) -7, multiplicity 1, crosses x-axis; 3, multiplicity 2, touches x-axis and turns around

Use the Intermediate Value Theorem to determine whether the polynomial function has a real zero between the given integers.

10) $f(x) = 8x^3 + 10x + 2$; between -1 and 0

A) $f(-1) = 16$ and $f(0) = -2$; yes

B) $f(-1) = 16$ and $f(0) = 2$; no

C) $f(-1) = -16$ and $f(0) = -2$; no

D) $f(-1) = -16$ and $f(0) = 2$; yes

11) $f(x) = 4x^3 - 3x^2 - 10x + 4$; between -2 and -1

A) $f(-2) = 20$ and $f(-1) = -7$; yes
B) $f(-2) = -20$ and $f(-1) = 7$; yes
C) $f(-2) = 20$ and $f(-1) = 7$; no
D) $f(-2) = -20$ and $f(-1) = -7$; no

Divide using synthetic division.

12) $\dfrac{x^4 - 3x^3 + x^2 + 6x - 7}{x - 1}$

A) $x^3 - 2x^2 + x + 7 + \dfrac{4}{x - 1}$
B) $x^3 + 2x^2 - x + 7 - \dfrac{2}{x - 1}$
C) $x^3 - 2x^2 - x + 5 - \dfrac{2}{x - 1}$
D) $x^3 - 2x^2 + x + 5 + \dfrac{4}{x - 1}$

Use the Rational Zero Theorem to list all possible rational zeros for the given function.

13) $f(x) = x^4 + 7x^3 - 4x^2 + 6x - 12$

A) $\pm\frac{1}{2}, \pm\frac{1}{3}, \pm\frac{1}{4}, \pm\frac{1}{6}, \pm\frac{1}{12}, \pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$

B) $\pm 1, \pm\frac{1}{2}, \pm\frac{1}{3}, \pm\frac{1}{4}, \pm\frac{1}{6}, \pm\frac{1}{12}$

C) $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$

D) $\pm\frac{1}{12}, \pm 1, \pm 12$

Use Descartes's Rule of Signs to determine the possible number of positive and negative real zeros for the given function.

14) $f(x) = -4x^9 + x^7 - x^2 + 6$

A) 3 or 1 positive zeros, 2 or 0 negative zeros
B) 2 or 0 positive zeros, 2 or 0 negative zeros
C) 3 or 1 positive zeros, 3 or 1 negative zeros
D) 2 or 0 positive zeros, 3 or 1 negative zeros

Find an nth degree polynomial function with real coefficients satisfying the given conditions.

15) n = 3; 3 and i are zeros; $f(2) = 20$

A) $f(x) = -4x^3 + 12x^2 - 4x + 12$
B) $f(x) = 4x^3 - 12x^2 - 4x + 12$
C) $f(x) = 4x^3 - 12x^2 + 4x - 12$
D) $f(x) = -4x^3 + 12x^2 + 4x - 12$

16) n = 3; 1 and $-2 + 3i$ are zeros; leading coefficient is 1

A) $f(x) = x^3 + 3x^2 + 9x - 13$
B) $f(x) = x^3 + 5x^2 + 9x - 14$
C) $f(x) = x^3 + 3x^2 + 15x - 13$
D) $f(x) = x^3 - 4x^2 + 9x - 13$

17) n = 4; 2i, 3, and -3 are zeros; leading coefficient is 1

A) $f(x) = x^4 + 4x^2 - 3x - 36$
B) $f(x) = x^4 + 4x^2 - 36$
C) $f(x) = x^4 - 5x^2 - 36$
D) $f(x) = x^4 + 4x^3 - 5x^2 - 36$

Find the vertical asymptotes, if any, of the graph of the rational function.

18) $h(x) = \dfrac{x}{x - 1}$

A) $x = 0$ and $x = 1$
B) $x = 0$ and $x = -1$
C) $x = 1$
D) no vertical asymptote

Find the horizontal asymptote, if any, of the graph of the rational function.

19) $f(x) = \frac{9x}{3x^2 + 1}$

A) $y = 3$

B) $y = \frac{1}{3}$

C) $y = 0$

D) no horizontal asymptote

Find the slant asymptote, if any, of the graph of the rational function.

20) $f(x) = \frac{x^2 - 6x + 3}{x + 8}$

A) $y = x + 9$

B) $x = y + 6$

C) $y = x - 14$

D) no slant asymptote

Find the domain of the rational function.

21) $g(x) = \frac{x + 8}{x^2 - 36}$

A) $\{x \mid x \neq -6, x \neq 6, x \neq -8\}$

B) $\{x \mid x \neq 0, x \neq 36\}$

C) $\{x \mid x \neq -6, x \neq 6\}$

D) all real numbers

Convert the angle in radians to degrees.

22) $-\frac{59}{18}\pi$

A) $-295°$

B) $-590°$

C) $-10°$

D) $-1180\pi°$

Convert the angle in degrees to radians. Round to two decimal places.

23) $167°$

A) 2.88 radians

B) 2.91 radians

C) 2.9 radians

D) 2.89 radians

The point P(x, y) on the unit circle that corresponds to a real number t is given. Find the value of the indicated trigonometric function at t.

24) $\left(\frac{2}{5}, \frac{\sqrt{21}}{5}\right)$ Find sin t.

A) $\frac{\sqrt{21}}{5}$

B) $\frac{\sqrt{21}}{2}$

C) $\frac{2\sqrt{21}}{21}$

D) $\frac{2}{5}$

25) $\left(-\frac{\sqrt{33}}{7}, \frac{4}{7}\right)$ Find cos t.

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

B) $-\frac{\sqrt{33}}{7}$

C) $-\frac{\sqrt{33}}{4}$

D) $-\frac{7\sqrt{33}}{33}$

Find the radian measure of the central angle of a circle of radius r that intercepts an arc of length s.

26) r = 2 inches, s = 6 inches

A) -3 radians

B) 3 radians

C) 3°

D) $\frac{1}{3}$ radians

Use the unit circle to find the value of the trigonometric function.

27) $\sec \frac{\pi}{3}$

A) $\frac{2\sqrt{3}}{3}$ B) $\sqrt{2}$ C) $\frac{\sqrt{3}}{2}$ D) 2

28) $\cos 45°$

A) $\frac{\sqrt{3}}{2}$ B) $\frac{1}{2}$ C) $\sqrt{2}$ D) $\frac{\sqrt{2}}{2}$

29) $\csc \frac{\pi}{3} - \cos \frac{\pi}{4}$

A) $\frac{4\sqrt{2} - 3\sqrt{3}}{6}$ B) $\frac{4 - \sqrt{2}}{2}$ C) $\frac{4 - \sqrt{3}}{2}$ D) $\frac{4\sqrt{3} - 3\sqrt{2}}{6}$

Find a cofunction with the same value as the given expression.

30) csc 83°

A) sin 83° B) sec 173° C) sec 7° D) sec 83°

A point on the terminal side of angle θ is given. Find the exact value of the indicated trigonometric function of θ.

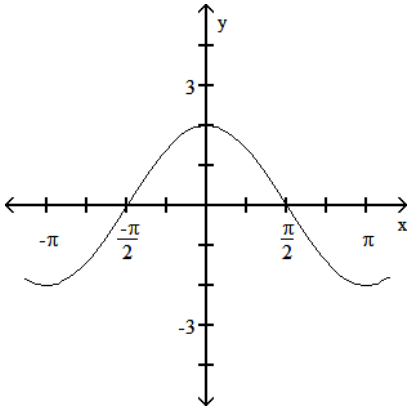
31) (3, -7) Find tan θ.

A) $-\frac{7}{3}$ B) $-\frac{7}{8}$ C) $-\frac{3}{7}$ D) $\frac{3}{8}$

Graph the function.

32) $y = 2 \sin\left(x + \frac{\pi}{2}\right)$

A)

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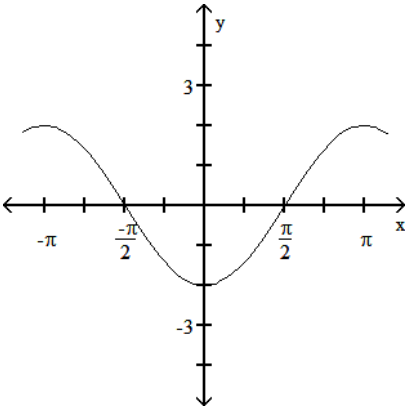


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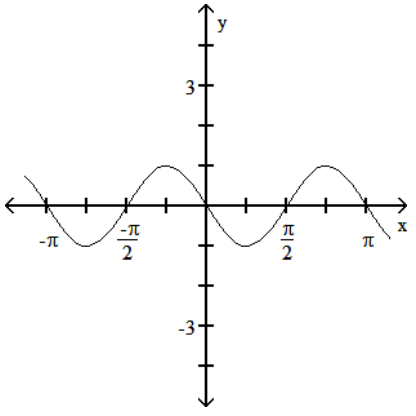


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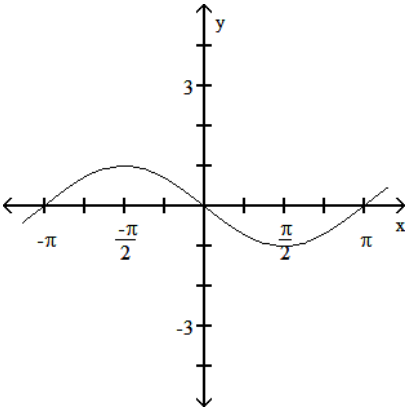
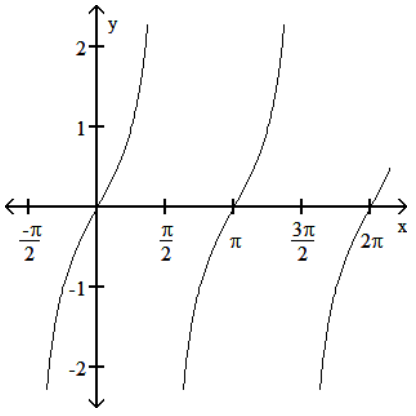


33) $y = \tan\left(x + \frac{\pi}{2}\right)$

A)

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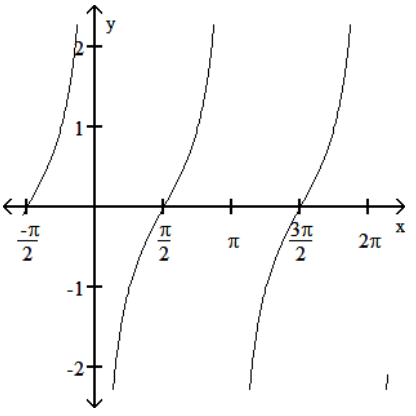


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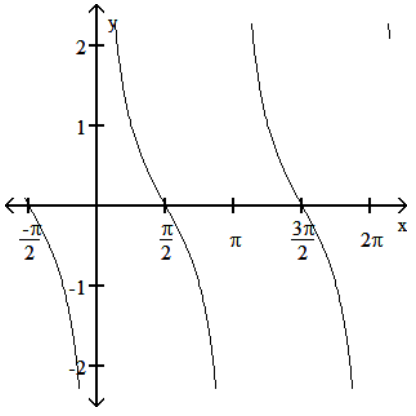


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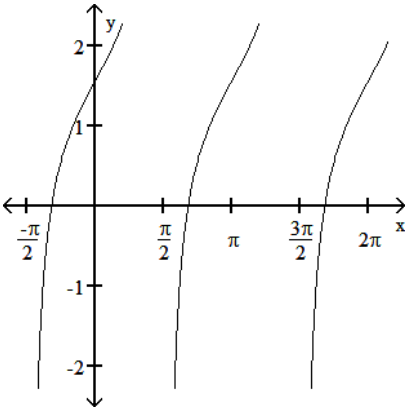
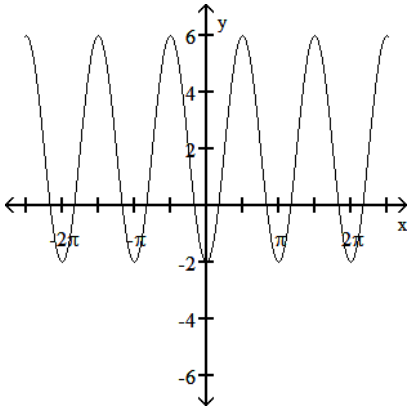


Use a vertical shift to graph the function.

34) $y = -4 \cos \frac{1}{2}x + 2$

A)

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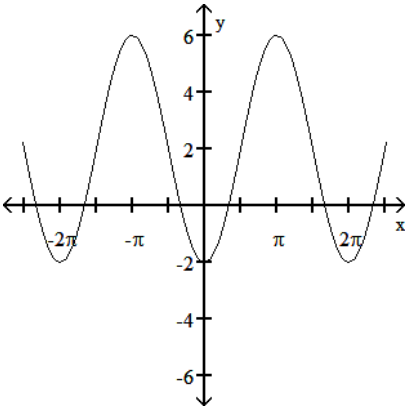


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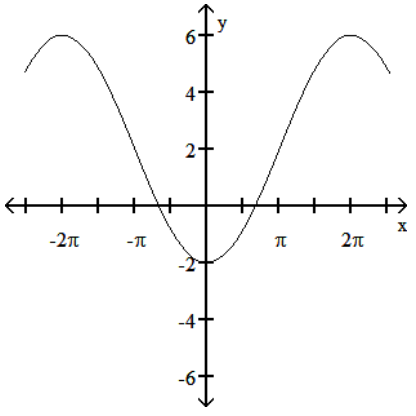


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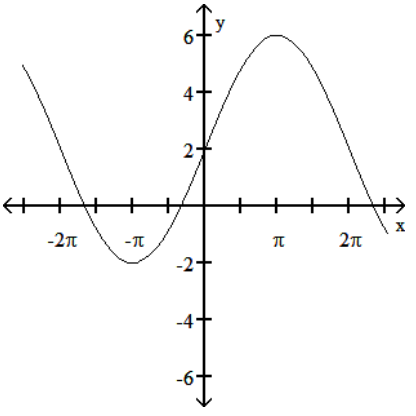
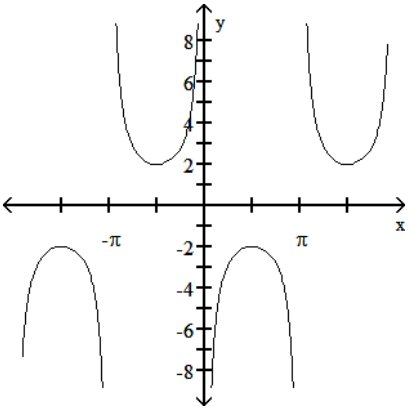


Graph the function.

35) $y = 2 \sec\left(x + \frac{\pi}{2}\right)$

A)

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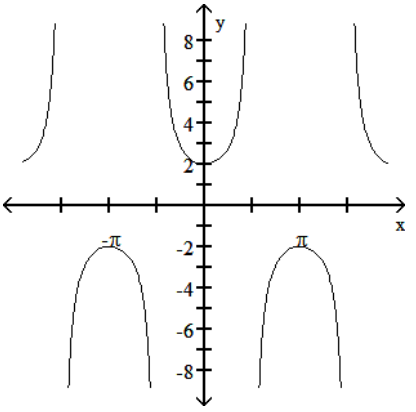
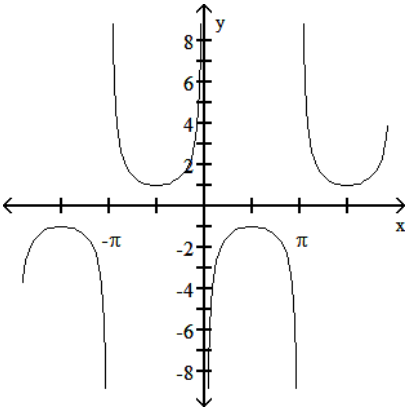
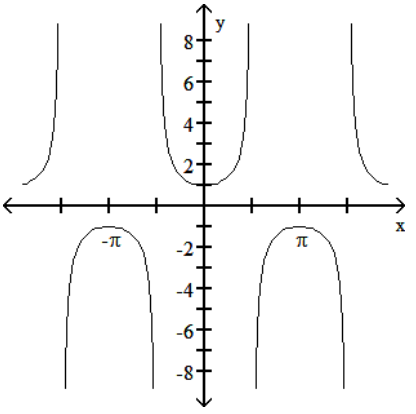



C)




D)




Find the exact value of the expression.

36) $\tan^{-1}\sqrt{3}$

A) $\frac{5\pi}{4}$ B) $\frac{\pi}{6}$ C) $\frac{\pi}{3}$ D) $\frac{3\pi}{4}$

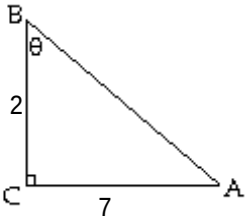
Use a sketch to find the exact value of the expression.

37) $\cos\left(\tan^{-1}\frac{4}{7}\right)$

A) $\frac{\sqrt{65}}{7}$ B) $\frac{7\sqrt{65}}{65}$ C) $\frac{4}{7}$ D) $\frac{7}{65}$

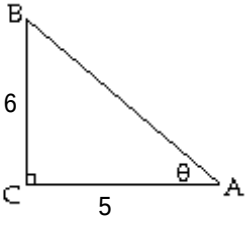
Use the Pythagorean Theorem to find the length of the missing side.Then find the indicated trigonometric function of the given angle. Give an exact answer with a rational denominator.

38) Find csc $\theta$.



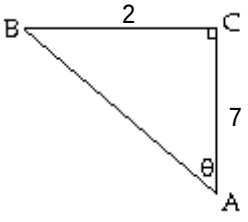

A) $\frac{2\sqrt{53}}{53}$ B) $\frac{\sqrt{53}}{7}$ C) $\frac{\sqrt{53}}{2}$ D) $\frac{7\sqrt{53}}{53}$

39) Find cos $\theta$.




A) $\frac{\sqrt{61}}{6}$ B) $\frac{5\sqrt{61}}{61}$ C) $\frac{\sqrt{61}}{5}$ D) $\frac{6\sqrt{61}}{61}$

40) Find cot $\theta$.




A) $\frac{7\sqrt{53}}{53}$ B) $\frac{2\sqrt{53}}{53}$ C) $\frac{7}{2}$ D) $\frac{2}{7}$

Solve the problem.

41) A building 290 feet tall casts a 100 foot long shadow. If a person stands at the end of the shadow and looks up to the top of the building, what is the angle of the person's eyes to the top of the building (to the nearest hundredth of a degree)? (Assume the person's eyes are 5 feet above ground level.)

A) 70.97° B) 69.46° C) 70.67° D) 20.54°

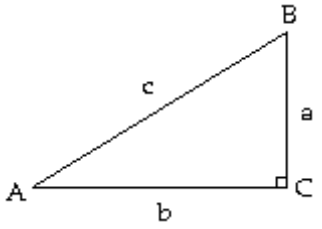
42) A surveyor is measuring the distance across a small lake. He has set up his transit on one side of the lake 140 feet from a piling that is directly across from a pier on the other side of the lake. From his transit, the angle between the piling and the pier is 70°. What is the distance between the piling and the pier to the nearest foot?

A) 48 feet B) 385 feet C) 51 feet D) 132 feet

43) A straight trail with a uniform inclination of 12° leads from a lodge at an elevation of 600 feet to a mountain lake at an elevation of 5100 feet. What is the length of the trail (to the nearest foot)?

A) 24,530 feet B) 21,644 feet C) 5214 feet D) 4601 feet

Solve the right triangle shown in the figure. Round lengths to one decimal place and express angles to the nearest tenth of a degree.




44) A = 31°, b = 49.3

A) B = 59°, a = 82, c = 95.7
B) B = 31°, a = 82, c = 42.3
C) B = 59°, a = 29.6, c = 57.5
D) B = 31°, a = 42.3, c = 29.6

Complete the identity.

45) tan x(cot x - cos x) = ?

A) 1
B) 0
C) $-\sec^2 x$
D) 1 - sin x

46) $1 - \dfrac{\cos^2 x}{1 + \sin x} = ?$

A) cot x
B) 0
C) tan x
D) sin x

Rewrite the expression in terms of the given function or functions.

47) $\sin^2 x + \sin x - 1 + \cos^2 x$; sin x

A) -sin x
B) 2sin x
C) 2 + sin x
D) sin x

48) (sec x + csc x) (sin x + cos x) - 2 - cot x; tan x

A) 2 + tan x
B) 0
C) 2tan x
D) tan x

Use an identity to find the value of the expression. Do not use a calculator.

49) sin 3.9 csc 3.9

A) -3.9
B) -1
C) 1
D) 3.9

Find the exact value by using a sum or difference identity.

50) cos (135° + 60°)

A) $-\dfrac{\sqrt{2}(\sqrt{3}+1)}{4}$
B) $\dfrac{\sqrt{2}(\sqrt{3}+1)}{4}$
C) $\dfrac{\sqrt{2}(\sqrt{3}-1)}{4}$
D) $-\dfrac{\sqrt{2}(\sqrt{3}-1)}{4}$

Use the given information to find the exact value of the expression.

51) $\sin\alpha = \dfrac{4}{5}$, $\alpha$ lies in quadrant II, and $\cos\beta = \dfrac{2}{5}$, $\beta$ lies in quadrant I  Find $\cos(\alpha - \beta)$.

A) $\dfrac{-6+4\sqrt{21}}{25}$
B) $\dfrac{8-3\sqrt{21}}{25}$
C) $\dfrac{8+3\sqrt{21}}{25}$
D) $\dfrac{6-4\sqrt{21}}{25}$

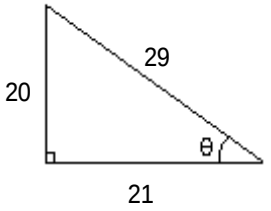
Write the expression as the sine, cosine, or tangent of a double angle. Then find the exact value of the expression.

52) $\cos^2 15° - \sin^2 15°$

A) $-\dfrac{1}{2}$
B) $\dfrac{\sqrt{3}}{2}$
C) $-\dfrac{\sqrt{3}}{2}$
D) $\dfrac{1}{2}$

Use the figure to find the exact value of the trigonometric function.

53) Find $\tan 2\theta$.




A) $\frac{41}{841}$ B) $\frac{840}{41}$ C) $\frac{840}{841}$ D) $\frac{42}{41}$

Find all solutions of the equation.

54) $6\cos x + 4\sqrt{2} = 4\cos x + 3\sqrt{2}$

A) $x = \frac{3\pi}{4} + 2n\pi$ or $x = \frac{5\pi}{4} + 2n\pi$

B) $x = \frac{\pi}{4} + 2n\pi$ or $x = \frac{7\pi}{4} + 2n\pi$

C) $x = \frac{\pi}{4} + n\pi$ or $x = \frac{7\pi}{4} + n\pi$

D) $x = \frac{3\pi}{4} + n\pi$ or $x = \frac{5\pi}{4} + n\pi$

55) $\tan x \sec x = -2\tan x$

A) $x = \frac{2\pi}{3} + n\pi$ or $x = \frac{4\pi}{3} + n\pi$ or $x = n\pi$

B) $x = \frac{\pi}{3} + n\pi$ or $x = \frac{5\pi}{3} + n\pi$ or $x = n\pi$

C) $x = \frac{2\pi}{3} + 2n\pi$ or $x = \frac{4\pi}{3} + 2n\pi$ or $x = n\pi$

D) $x = \frac{\pi}{3} + 2n\pi$ or $x = \frac{5\pi}{3} + 2n\pi$ or $x = n\pi$

Solve the equation on the interval $[0, 2\pi)$.

56) $\cos^2 x + 2\cos x + 1 = 0$

A) $\pi$ B) $\frac{\pi}{2}, \frac{3\pi}{2}$ C) $2\pi$ D) $\frac{\pi}{4}, \frac{7\pi}{4}$

Express the product as a sum or difference.

57) $\sin 8x \sin 4x$

A) $\sin^2 32x^2$

B) $\frac{1}{2}(\sin 12x + \cos 4x)$

C) $\frac{1}{2}(\cos 12x - \cos 4x)$

D) $\frac{1}{2}(\cos 4x - \cos 12x)$

Express the sum or difference as a product.

58) $\cos 3x - \cos 5x$

A) $\cos(-2x)$ B) $-2\cos 4x \sin x$ C) $-2\sin 4x \sin x$ D) $2\sin 4x \sin x$