EOT1 Coverage Answers

12 General

Ms. Lana

1	Identify and evaluate functions and state their domains التعرف على الدوال وإيجاد قيمها وتحديد مجالاتها	(39-46)	10

39. $f(x) = \dfrac{8x+12}{x^2+5x+4}$

SOLUTION:

When the denominator of $f(x) = \dfrac{8x+12}{x^2+5x+4}$ is zero, the expression is undefined.

$$x^2+5x+4=0$$
$$(x+4)(x+1)=0$$
$$x=-4 \quad x=-1$$

Therefore, the domain of this function is all real numbers except $x = -4$ and $x = -1$, which can be written as $(-\infty, -4) \cup (-4, -1) \cup (-1, \infty)$.

ANSWER:

$(-\infty, -4) \cup (-4, -1) \cup (-1, \infty)$

40. $g(x) = \dfrac{x+1}{x^2-3x-40}$

SOLUTION:

When the denominator of $g(x) = \dfrac{x+1}{x^2-3x-40}$ is zero, the expression is undefined.

$$x^2-3x-40=0$$
$$(x-8)(x+5)=0$$
$$x=8 \quad x=-5$$

Therefore, the domain of $g(x)$ is all real numbers except $x = 8$ and $x = -5$, which can be written as $(-\infty\ -5) \cup (-5, 8) \cup (8, \infty)$.

ANSWER:

$(-\infty, -5) \cup (-5, 8) \cup (8, \infty)$

41. $g(a) = \sqrt{1+a^2}$

SOLUTION:

There is no value of a that will make the expression $\sqrt{1+a^2}$ undefined. Any value that is squared will be nonnegative. Any nonnegative number plus one will also always be nonnegative. Therefore, the domain of $g(a)$ includes all real numbers or $(-\infty, \infty)$.

ANSWER:

$(-\infty, \infty)$

42. $h(x) = \sqrt{6 - x^2}$

SOLUTION:

The square root of a negative number cannot be a real number, so $6 - x^2 \geq 0$.

$$6 - x^2 \geq 0$$
$$6 \geq x^2$$
$$\sqrt{6} \geq \pm x$$
$$x \leq \sqrt{6} \text{ or } x \geq -\sqrt{6}$$

If $6 - x^2 \geq 0$, then $x \leq \sqrt{6}$ or $x \geq -\sqrt{6}$.

If x were greater than $\sqrt{6}$ or less than $-\sqrt{6}$, the expression $6 - x^2$ would be negative, and thus would not be a real number.

The domain of $h(x)$ is $[-\sqrt{6}, \sqrt{6}]$.

ANSWER:

$[-\sqrt{6}, \sqrt{6}]$

43. $f(a) = \dfrac{5a}{\sqrt{4a-1}}$

SOLUTION:

This function is defined only when $4a - 1 > 0$.

$$4a - 1 > 0$$
$$4a > 1$$
$$a > 0.25$$

The domain of $f(a)$ is $(0.25, \infty)$.

ANSWER:

$(0.25, \infty)$

1	Identify and evaluate functions and state their domains التعرف على الدوال وإيجاد قيمها وتحديد مجالاتها	(39-46)	10

44. $g(x) = \dfrac{3}{\sqrt{x^2 - 16}}$

SOLUTION:

This function is defined only when $x^2 - 16 > 0$.

$$x^2 - 16 > 0$$
$$x^2 > 16$$
$$\pm x > 4$$
$$x > 4 \text{ or } x < -4$$

If x were greater than –4 or less than 4, the radicand would be negative, and thus would not be a real number.

The domain of $g(x)$ is $(-\infty, -4) \cup (4, \infty)$.

ANSWER:

$(-\infty, -4) \cup (4, \infty)$

45. $f(x) = \dfrac{2}{x} + \dfrac{4}{x+1}$

SOLUTION:

This function is defined only when $x \neq 0$ and $x + 1 \neq 0$. Therefore, the function is defined for all real numbers except $x = 0$ and $x = -1$. The domain of $f(x)$ is $(-\infty, -1) \cup (-1, 0) \cup (0, \infty)$.

ANSWER:

$(-\infty, -1) \cup (-1, 0) \cup (0, \infty)$

46. $g(x) = \dfrac{6}{x+3} + \dfrac{2}{x-4}$

SOLUTION:

This function is defined only when $x + 3 \neq 0$ and $x - 4 \neq 0$. Therefore, the function is defined for all real numbers except $x = -3$ and $x = 4$. The domain of $g(x)$ is $(-\infty, -3) \cup (-3, 4) \cup (4, \infty)$.

ANSWER:

$(-\infty, -3) \cup (-3, 4) \cup (4, \infty)$

16. *ANSWER:*

no y-intercept; zero: 1;

$$\sqrt{x-1}=0$$
$$\left(\sqrt{x-1}\right)^2=(0)^2$$
$$x-1=0$$
$$x=1$$

17. *ANSWER:*

y-intercept: 0; zeros: $-1, 0, \frac{3}{2}$;

$$2x^3-x^2-3x=0$$
$$x(2x-3)(x+1)=0$$
$$x=0 \text{ or } 2x-3=0 \text{ or } x+1=0$$
$$x=\frac{3}{2} \qquad x=-1$$

18. *ANSWER:*

y-intercept: 0; zero: 0;

$$\sqrt[3]{x}=0$$
$$(\sqrt[3]{x})^3=(0)^3$$
$$x=0$$

19. *ANSWER:*

y-intercept: 3; no zeros;

$$\sqrt{x}+3=0$$
$$\sqrt{x}\neq -3$$

20. *ANSWER:*

y-intercept: 9; zero: 3;

$$x^2-6x+9=0$$
$$(x-3)^2=0$$
$$x-3=0$$
$$x=3$$

21. *ANSWER:*

y-intercept: -2; zeros: $-\frac{1}{2}, \frac{2}{3}$;

$$6x^2-x-2=0$$
$$(2x+1)(3x-2)=0$$
$$2x+1=0 \text{ or } 3x-2=0$$
$$x=-\frac{1}{2} \qquad x=\frac{2}{3}$$

22. *ANSWER:*

y-intercept: 8; zero: -2;

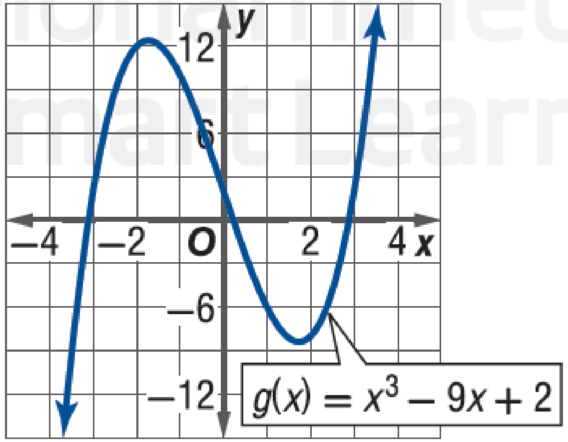
23. *ANSWER:*

y-intercept: 6; zeros: $-2, -3$;

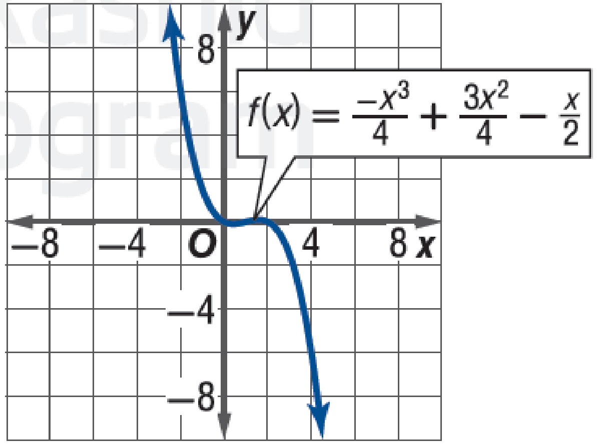
$$x^2+5x+6=0$$
$$(x+2)(x+3)=0$$
$$x+2=0 \text{ or } x+3=0$$
$$x=-2 \qquad x=-3$$

Use the graph of each function to describe its end behavior. Support the conjecture numerically.

4A.

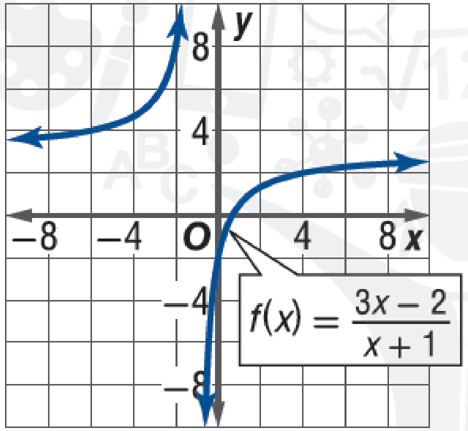


4B.

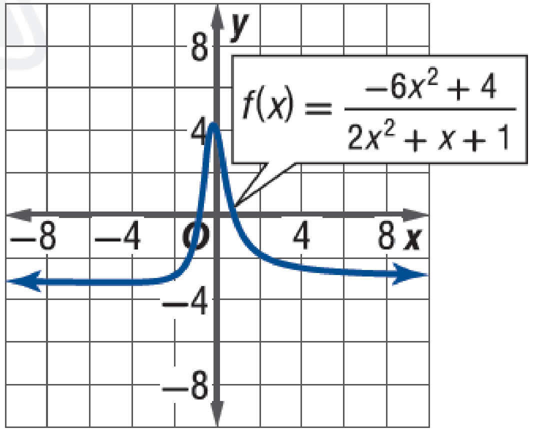


Use the graph of each function to describe its end behavior. Support the conjecture numerically.

5A.



5B.



3	Use limits to describe the end behavior of function استخدام النهايات لوصف السلوك الطرفي للدوال	Example-4 -مثال+(4A,4B) & Example-5 -مثال+(5A,5B) (22-29)	28 & 29 30

22.

ANSWER:

From the graph, it appears that $f(x) \to \infty$ as $x \to -\infty$ and $f(x) \to \infty$ as $x \to \infty$.

23.

ANSWER:

From the graph, it appears that $f(x) \to \infty$ as $x \to -\infty$ and $f(x) \to -\infty$ as $x \to \infty$.

24.

ANSWER:

From the graph, it appears that $f(x) \to -\infty$ as $x \to -\infty$ and $f(x) \to \infty$ as $x \to \infty$.

25.

ANSWER:

From the graph, it appears that $f(x) \to -4$ as $x \to -\infty$ and $f(x) \to -4$ as $x \to \infty$.

26.

ANSWER:

From the graph, it appears that $f(x) \to -\infty$ as $x \to -\infty$ and $f(x) \to \infty$ as $x \to \infty$.

27.

ANSWER:

From the graph, it appears that $f(x) \to 0$ as $x \to -\infty$ and $f(x) \to 0$ as $x \to \infty$.

3	Use limits to describe the end behavior of function	Example-4 -مثال+(4A,4B) & Example-5 -مثال+(5A,5B)	28 & 29
	استخدام النهايات لوصف السلوك الطرفي للدوال	(22-29)	30

28.

ANSWER:

From the graph, it appears that $f(x) \to 7$ as $x \to -\infty$ and $f(x) \to 7$ as $x \to \infty$.

29.

ANSWER:

From the graph, it appears that $f(x) \to -2$ as $x \to -\infty$ and $f(x) \to -2$ as $x \to \infty$.

4	Find intervals on which functions are increasing, constant, or decreasing تحديد الفترات التي تكون عندها الدوال متزايدة أو ثابتة أو متناقصة	(1-10)	40

1.

ANSWER:

f is increasing on $(-\infty, -0.5)$, decreasing on $(-0.5, 1)$, and increasing on $(1, \infty)$.

2.

ANSWER:

f is decreasing on $(-\infty, -2.5)$, increasing on $(-2.5, 0)$, and decreasing on $(0, \infty)$.

3.

ANSWER:

f is decreasing on $(-\infty, 2.5)$ and increasing on $(2.5, \infty)$.

4.

ANSWER:

f is decreasing on $(-\infty, -1.5)$, increasing on $(-1.5, 1.5)$, and decreasing on $(1.5, \infty)$.

5.

ANSWER:

f is increasing on $(-\infty, 0)$ and increasing on $(0, \infty)$.

6.

ANSWER:

f is increasing on $(-\infty, -6)$, decreasing on $(-6, -3)$, decreasing on $(-3, 0)$, and increasing on $(0, \infty)$.

4	Find intervals on which functions are increasing, constant, or decreasing تحديد الفترات التي تكون عندها الدوال متزايدة أو ثابتة أو متناقصة	(1-10)	40

7.

ANSWER:

f is increasing on $(-\infty, -2)$, decreasing on $(0, 4)$, and increasing on $(4, \infty)$.

8.

ANSWER:

f is increasing on $(-\infty, -4)$, decreasing on $(-4, 4)$, increasing on $(4, 5)$, and decreasing on $(5, \infty)$.

9.

ANSWER:

f is constant on $(-\infty, -5)$, increasing on $(-5, -3.5)$, and decreasing on $(-3.5, \infty)$.

10.

ANSWER:

f is increasing on $(-\infty, \infty)$.

5	Graph and analyze radical functions and solve radical equations تمثيل الدوال الجذرية بيانيًا وتحليلها وحل المعادلات الجذرية	Example-6 -مثال+(6A,6B,6C) (44-55)	91 93

6A. $3x = 3 + \sqrt{18x - 18}$

6B. $\sqrt[3]{4x + 8} + 3 = 7$

6C. $\sqrt{x + 7} = 3 + \sqrt{2 - x}$

44. $4 = \sqrt{-6 - 2x} + \sqrt{31 - 3x}$

ANSWER:

no solution

45. $0.5x = \sqrt{4 - 3x} + 2$

ANSWER:

no solution

46. $-3 = \sqrt{22 - x} - \sqrt{3x - 3}$

ANSWER:

13

47. $\sqrt{(2x - 5)^3} - 10 = 17$

ANSWER:

7

48. $\sqrt[4]{(4x + 164)^3} + 36 = 100$

ANSWER:

23

49. $x = \sqrt{2x - 4} + 2$

ANSWER:

2, 4

50. $7 + \sqrt{(-36 - 5x)^5} = 250$

ANSWER:

−9

51. $x = 5 + \sqrt{x + 1}$

ANSWER:

8

52. $\sqrt{6x - 11} + 4 = \sqrt{12x + 1}$

ANSWER:

2, 10

53. $\sqrt{4x - 40} = -20$

ANSWER:

no solution

54. $\sqrt{x + 2} - 1 = \sqrt{-2 - 2x}$

ANSWER:

−1

55. $7 + \sqrt[5]{1054 - 3x} = 11$

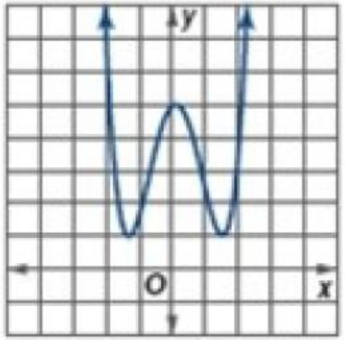
ANSWER:

10

Describe the end behavior of the graph of each polynomial function using limits. Explain your reasoning using the leading term test.

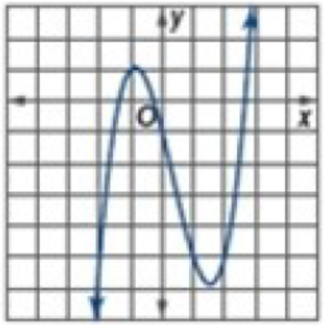
2A. $g(x) = 4x^5 - 8x^3 + 20$

2B. $h(x) = -2x^6 + 11x^4 + 2x^2$

64. 

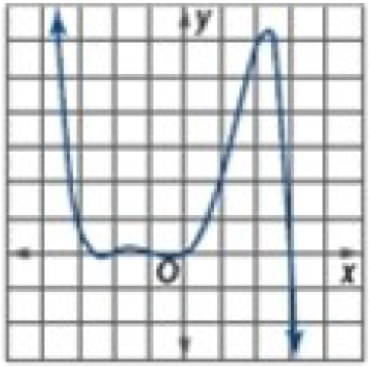
SOLUTION:

Since $\lim_{x \to -\infty} f(x) = \infty$ and $\lim_{x \to \infty} f(x) = \infty$, n is even and a_n is positive.

65. 

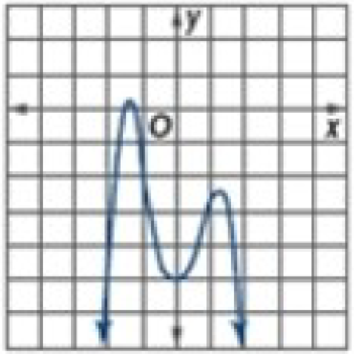
SOLUTION:

Since $\lim_{x \to -\infty} f(x) = -\infty$ and $\lim_{x \to \infty} f(x) = \infty$, n is odd and a_n is positive.

66. 

SOLUTION:

Since $\lim_{x \to -\infty} f(x) = \infty$ and $\lim_{x \to \infty} f(x) = -\infty$, n is odd and a_n is negative.

67. 

SOLUTION:

Since $\lim_{x \to -\infty} f(x) = -\infty$ and $\lim_{x \to \infty} f(x) = -\infty$, n is even and a_n is negative.

Divide using long division.

10. $(x^6 - 2x^5 + x^4 - x^3 + 3x^2 - x + 24) \div (x + 2)$

SOLUTION:

$$
\begin{array}{r}
x^5 - 4x^4 + 9x^3 - 19x^2 + 41x - 83 \\
x+2\;\overline{)\,x^6 - 2x^5 + x^4 - x^3 + 3x^2 - x + 24} \\
(-)\underline{[x^6 + 2x^5]} \qquad\qquad\qquad\qquad\qquad \\
-4x^5 + x^4 \qquad\qquad\qquad\qquad \\
(-)\underline{[-4x^5 - 8x^4]} \qquad\qquad\qquad\qquad \\
9x^4 - x^3 \qquad\qquad\qquad \\
(-)\underline{[9x^4 + 18x^3]} \qquad\qquad\qquad \\
-19x^3 + 3x^2 \qquad\qquad \\
(-)\underline{[-19x^3 - 38x^2]} \qquad\qquad \\
41x^2 - x \qquad \\
(-)\underline{[41x^2 + 82x]} \qquad \\
-83x + 24 \\
(-)\underline{[-83x - 166]} \\
190
\end{array}
$$

$x^5 - 4x^4 + 9x^3 - 19x^2 + 41x - 83 + \dfrac{190}{x+2}$.

11. $(4x^4 - 8x^3 + 12x^2 - 6x + 12) \div (2x + 4)$

SOLUTION:

$$
\begin{array}{r}
2x^3 - 8x^2 + 22x - 47 \\
2x+4\;\overline{)\,4x^4 - 8x^3 + 12x^2 - 6x + 12} \\
(-)\underline{[4x^4 + 8x^3]} \qquad\qquad\qquad\qquad \\
-16x^3 + 12x^2 \qquad\qquad\qquad \\
(-)\underline{[-16x^3 - 32x^2]} \qquad\qquad\qquad \\
44x^2 - 6x \qquad\qquad \\
(-)\underline{[44x^2 + 88x]} \qquad\qquad \\
-94x + 12 \\
(-)\underline{-94x - 188} \\
200
\end{array}
$$

The remainder $\dfrac{200}{2x+4}$ can be written as $\dfrac{100}{x+2}$.

$2x^3 - 8x^2 + 22x - 47 + \dfrac{100}{x+2}$

12. $(2x^4 - 7x^3 - 38x^2 + 103x + 60) \div (x - 3)$

SOLUTION:

$$\begin{array}{r} 2x^3 - x^2 - 41x - 20 \\ x-3 \enclose{longdiv}{2x^4 - 7x^3 - 38x^2 + 103x + 60} \\ (-)\underline{\left[2x^4 - 6x^3\right]} \\ -x^3 - 38x^2 \\ (-)\underline{\left[-x^3 + 3x^2\right]} \\ -41x^2 + 103x \\ (-)\underline{\left[-41x^2 + 123x\right]} \\ -20x + 60 \\ (-)\underline{[-20x + 60]} \\ 0 \end{array}$$

$2x^3 - x^2 - 41x - 20$

13. $(6x^6 - 3x^5 + 6x^4 - 15x^3 + 2x^2 + 10x - 6) \div (2x - 1)$

SOLUTION:

$$\begin{array}{r} 3x^5 + 3x^3 - 6x^2 - 2x + 4 \\ 2x-1 \enclose{longdiv}{6x^6 - 3x^5 + 6x^4 - 15x^3 + 2x^2 + 10x - 6} \\ (-)\underline{6x^6 - 3x^5} \\ 0x^5 + 6x^4 - 15x^3 \\ (-)\underline{\left[6x^4 - 3x^3\right]} \\ -12x^3 + 2x^2 \\ (-)\underline{\left[-12x^3 + 6x^2\right]} \\ -4x^2 + 10x \\ (-)\underline{\left[-4x^2 + 2x\right]} \\ 8x - 6 \\ (-)\underline{[8x - 4]} \\ -2 \end{array}$$

$3x^5 + 3x^3 - 6x^2 - 2x + 4 - \dfrac{2}{2x-1}$

Divide using synthetic division.

19. $(x^4 - x^3 + 3x^2 - 6x - 6) \div (x - 2)$

SOLUTION:

Because $x - 2$, $c = 2$. Set up the synthetic division as follows. Then follow the synthetic division procedure.

$$\begin{array}{r|rrrrr} 2 & 1 & -1 & 3 & -6 & -6 \\ & & 2 & 2 & 10 & 8 \\ \hline & 1 & 1 & 5 & 4 & \vert 2 \end{array}$$

The quotient is $x^3 + x^2 + 5x + 4 + \dfrac{2}{x-2}$.

20. $(2x^4 + 4x^3 - 2x^2 + 8x - 4) \div (x + 3)$

SOLUTION:

Because $x + 3$, $c = -3$. Set up the synthetic division as follows. Then follow the synthetic division procedure.

$$\begin{array}{r|rrrrr} -3 & 2 & 4 & -2 & 8 & -4 \\ & & -6 & 6 & -12 & 12 \\ \hline & 2 & -2 & 4 & -4 & \vert 8 \end{array}$$

The quotient is $2x^3 - 2x^2 + 4x - 4 + \dfrac{8}{x+3}$.

21. $(3x^4 - 9x^3 - 24x - 48) \div (x - 4)$

SOLUTION:

Because $x - 4$, $c = 4$. Set up the synthetic division as follows, using a zero placeholder for the missing x^2-term in the dividend. Then follow the synthetic division procedure.

$$\begin{array}{r|rrrrr} 4 & 3 & -9 & 0 & -24 & -48 \\ & & 12 & 12 & 48 & 96 \\ \hline & 3 & 3 & 12 & 24 & \vert 48 \end{array}$$

The quotient is $3x^3 + 3x^2 + 12x + 24 + \dfrac{48}{x-4}$.

22. $(x^5 - 3x^3 + 6x^2 + 9x + 6) \div (x + 2)$

SOLUTION:

Because $x + 2$, $c = -2$. Set up the synthetic division as follows, using a zero placeholder for the missing x^4-term in the dividend. Then follow the synthetic division procedure.

$$\begin{array}{r|rrrrrr} -2 & 1 & 0 & -3 & 6 & 9 & 6 \\ & & -2 & 4 & -2 & -8 & -2 \\ \hline & 1 & -2 & 1 & 4 & 1 & \vert 4 \end{array}$$

The quotient is $x^4 - 2x^3 + x^2 + 4x + 1 + \dfrac{4}{x+2}$.

19. $\dfrac{x+6}{x-5} \le 1$

SOLUTION:

$$\frac{x+6}{x-5} \le 1$$

$$\frac{x+6}{x-5} - 1 \le 0$$

$$\frac{x+6}{x-5} - 1\left(\frac{x-5}{x-5}\right) \le 0$$

$$\frac{x+6}{x-5} - \frac{x-5}{x-5} \le 0$$

$$\frac{11}{x-5} \le 0$$

Let $f(x) = \dfrac{11}{x-5}$. There are no zeros because the numerator has no real zeros. The undefined point of the inequality is the zero of the denominator, $x = 5$. Create a sign chart. Then choose and test x-values in each interval to determine if $f(x)$ is positive or negative.

$$\frac{11}{x-5} \ ? \ 0$$

$$\frac{11}{0-5} \ ? \ 0$$

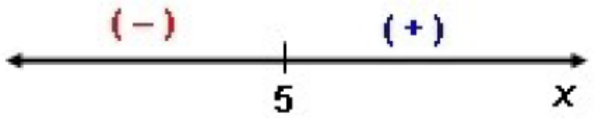
$$\frac{11}{-5} \ ? \ 0$$

$$-\frac{11}{5} < 0$$

$$\frac{11}{x-5} \ ? \ 0$$

$$\frac{11}{10-5} \ ? \ 0$$

$$\frac{11}{5} < 0$$



The solutions of $\dfrac{11}{x-5} \le 0$ are x-values such that $f(x)$ is negative or equal to 0. From the sign chart, you can see that the solution set is $(-\infty, 5)$. $x = 5$ is not part of the solution set because the original inequality is undefined at $x = 5$.

21. $\frac{3x-2}{x+3} < 6$

SOLUTION:

$$\frac{3x-2}{x+3} < 6$$

$$\frac{3x-2}{x+3} - 6 < 0$$

$$\frac{3x-2}{x+3} - 6\left(\frac{x+3}{x+3}\right) < 0$$

$$\frac{3x-2}{x+3} - \frac{6x+18}{x+3} < 0$$

$$\frac{-3x-20}{x+3} < 0$$

Let $f(x) = \frac{-3x-20}{x+3}$. The zeros and undefined points of the inequality are the zeros of the numerator, $x = -\frac{20}{3}$, and denominator, $x = -3$. Create a sign chart. Then choose and test x-values in each interval to determine if $f(x)$ is positive or negative.

$$\frac{-3x-20}{x+3} \; ? \; 0$$

$$\frac{-3(-10)-20}{(-10)+3} \; ? \; 0$$

$$\frac{10}{-7} \; ? \; 0$$

$$-\frac{10}{7} < 0$$

$$\frac{-3x-20}{x+3} \; ? \; 0$$

$$\frac{-3(-4)-20}{(-4)+3} \; ? \; 0$$

$$\frac{-32}{-1} \; ? \; 0$$

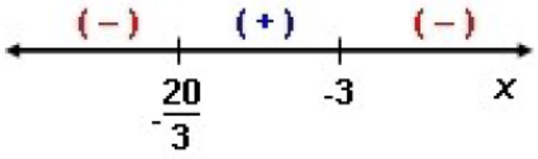
$$32 > 0$$

$$\frac{-3x-20}{x+3} \; ? \; 0$$

$$\frac{-3(0)-20}{(0)+3} \; ? \; 0$$

$$\frac{-20}{3} \; ? \; 0$$

$$-\frac{20}{3} < 0$$



The solutions of $\frac{-3x-20}{x+3} < 0$ are x-values such that $f(x)$ is negative. From the sign chart, you can see that the solution set is $\left(-\infty, -\frac{20}{3}\right) \cup (-3, \infty)$.

23. $\dfrac{4x+1}{3x-5} \geq -3$

SOLUTION:

$$\frac{4x+1}{3x-5} \geq -3$$

$$\frac{4x+1}{3x-5} + 3 \geq 0$$

$$\frac{4x+1}{3x-5} + 3\left(\frac{3x-5}{3x-5}\right) \geq 0$$

$$\frac{4x+1}{3x-5} + \frac{9x-15}{3x-5} \geq 0$$

$$\frac{13x-14}{3x-5} \geq 0$$

Let $f(x) = \dfrac{13x-14}{3x-5}$. The zeros and undefined points of the inequality are the zeros of the numerator, $x = \dfrac{14}{13}$, and denominator, $x = \dfrac{5}{3}$. Create a sign chart. Then choose and test x-values in each interval to determine if $f(x)$ is positive or negative.

$$\frac{13x-14}{3x-5} \ ? \ 0$$

$$\frac{13(0)-14}{3(0)-5} \ ? \ 0$$

$$\frac{-14}{-5} \ ? \ 0$$

$$\frac{14}{5} > 0$$

$$\frac{13x-14}{3x-5} \ ? \ 0$$

$$\frac{13\left(\frac{4}{3}\right)-14}{3\left(\frac{4}{3}\right)-5} \ ? \ 0$$

$$\frac{\frac{10}{3}}{-1} \ ? \ 0$$

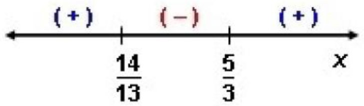
$$-\frac{10}{3} < 0$$

$$\frac{13x-14}{3x-5} \ ? \ 0$$

$$\frac{13(2)-14}{3(2)-5} \ ? \ 0$$

$$\frac{12}{1} \ ? \ 0$$

$$12 > 0$$



The solutions of $\dfrac{13x-14}{3x-5} \geq 0$ are x-values such that $f(x)$ is positive or equal to 0. From the sign chart, you can see that the solution set is $\left(-\infty, \dfrac{14}{13}\right] \cup \left(\dfrac{5}{3}, \infty\right)$. $x = \dfrac{5}{3}$ is not part of the solution set because the original inequality is undefined at $x = \dfrac{5}{3}$.

25. $\dfrac{(4x+1)(x-2)}{(x+3)(x-1)} \le 4$

SOLUTION:

$$\frac{(4x+1)(x-2)}{(x+3)(x-1)} \le 4$$

$$\frac{(4x+1)(x-2)}{(x+3)(x-1)} - 4 \le 0$$

$$\frac{(4x+1)(x-2)}{(x+3)(x-1)} - 4\left[\frac{(x+3)(x-1)}{(x+3)(x-1)}\right] \le 0$$

$$\frac{(4x+1)(x-2)-4(x+3)(x-1)}{(x+3)(x-1)} \le 0$$

$$\frac{(4x^2-7x-2)-(4x^2+8x-12)}{(x+3)(x-1)} \le 0$$

$$\frac{-15x+10}{(x+3)(x-1)} \le 0$$

$$\frac{-5(3x-2)}{(x+3)(x-1)} \le 0$$

Let $f(x)=\dfrac{-5(3x-2)}{(x+3)(x-1)}$. The zeros and undefined points of the inequality are the zeros of the numerator, $x=\dfrac{2}{3}$, and denominator, $x=-3$ and $x=1$.

1. Create a sign chart. Then choose and test x-values in each interval to determine if $f(x)$ is positive or negative.

$$\frac{-5(3x-2)}{(x+3)(x-1)} \ ? \ 0$$

$$\frac{-5(3(-4)-2)}{((-4)+3)((-4)-1)} \ ? \ 0$$

$$\frac{-5(-14)}{(-1)(-5)} \ ? \ 0$$

$$14 > 0$$

$$\frac{-5(3x-2)}{(x+3)(x-1)} \ ? \ 0$$

$$\frac{-5(3(0)-2)}{((0)+3)((0)-1)} \ ? \ 0$$

$$\frac{-5(-2)}{(3)(-1)} \ ? \ 0$$

$$-10 < 0$$

$$\frac{-5(3x-2)}{(x+3)(x-1)} \ ? \ 0$$

$$\frac{-5\left(3\left(\frac{5}{6}\right)-2\right)}{\left(\left(\frac{5}{6}\right)+3\right)\left(\left(\frac{5}{6}\right)-1\right)} \ ? \ 0$$

$$\frac{-5\left(\frac{1}{2}\right)}{\left(\frac{23}{6}\right)\left(-\frac{1}{6}\right)} \ ? \ 0$$

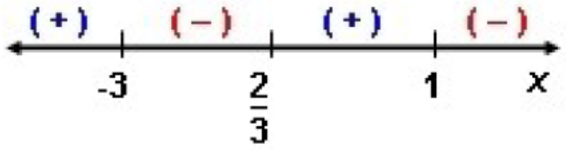
$$\frac{90}{23} > 0$$

$$\frac{-5(3x-2)}{(x+3)(x-1)} \ ? \ 0$$

$$\frac{-5(3(2)-2)}{((2)+3)((2)-1)} \ ? \ 0$$

$$\frac{-5(4)}{(5)(1)} \ ? \ 0$$

$$-4 < 0$$



The solutions of $\dfrac{-5(3x-2)}{(x+3)(x-1)} \le 0$ are x-values such that $f(x)$ is negative or equal to 0. From the sign chart, you can see that the solution set is $\left(-3, \dfrac{2}{3}\right] \cup (1, \infty)$. $x=-3$ and $x=1$ are not part of the solution set because the original inequality is undefined at $x=-3$ and $x=1$.

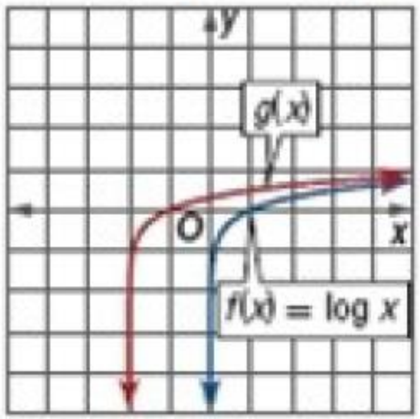
Use the graph of $f(x) = \ln x$ to describe the transformation that results in each function. Then sketch the graphs of the functions.

6A. $a(x) = \ln(x - 6)$

6B. $b(x) = 0.5 \ln x - 2$

6C. $c(x) = \ln(x + 4) + 3$

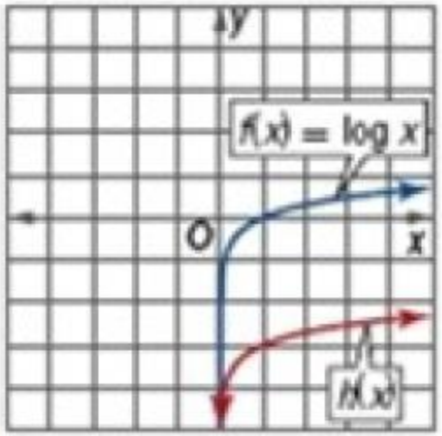
60.



ANSWER:

$g(x) = \log(x + 2)$

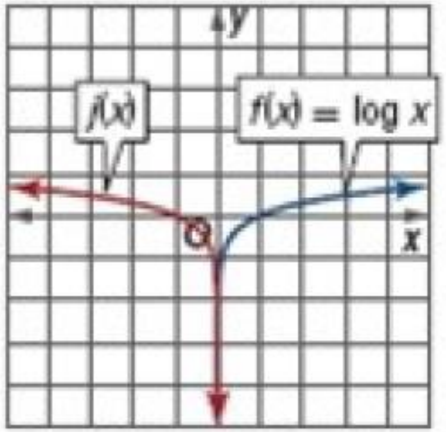
61.



ANSWER:

$h(x) = \log x - 3$

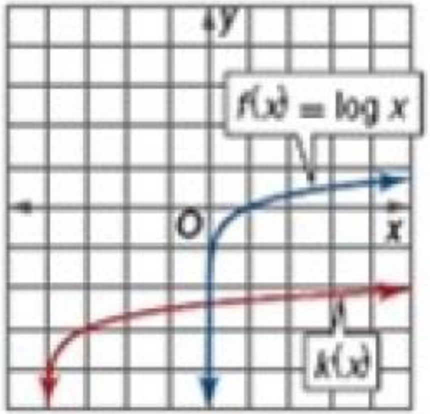
62.



ANSWER:

$j(x) = \log(-x)$

63.



ANSWER:

$k(x) = \log(x + 4) - 3$

Condense each expression.

4A. $-5 \log_2 (x + 1) + 3 \log_2 (6x)$

4B. $\ln (3x + 5) - 4 \ln x - \ln (x - 1)$

39.

ANSWER:

$\log_5 \frac{x^3}{\sqrt{6-x}}$ or $\log_5 \frac{x^3\sqrt{6-x}}{6-x}$

41.

ANSWER:

$\log_3 \frac{a^7 b}{64c^2}$

43.

ANSWER:

$\log_8 \frac{81x^2}{(2x-5)}$

40.

ANSWER:

$\log_7 \frac{32x^5}{\sqrt[3]{5x+1}}$ or $\log_7 \frac{32x^5\sqrt[3]{(5x+1)^2}}{5x+1}$

42.

ANSWER:

$\ln \frac{(x+3)^4}{\sqrt[5]{4x+7}}$ or $\frac{(x+3)^4\sqrt[5]{(4x+7)^4}}{4x+7}$

44.

ANSWER:

$\ln 13a^7b^{-11}c$

45.

ANSWER:

$$\log_6 25a^2bc^7$$

46.

ANSWER:

$$\log_2 \frac{x}{yz^3}$$

47.

ANSWER:

$$\ln \frac{\sqrt[4]{2a-b}}{\sqrt[5]{3b+c}} \text{ or } \ln \frac{\sqrt[4]{2a-b}\cdot\sqrt[5]{(3b+c)^4}}{3b+c}$$

48.

ANSWER:

$$\log_3 \frac{4}{\sqrt{6x-5}} \text{ or } \log_3 \frac{4\sqrt{6x-5}}{6x-5}$$

11	Convert degree measures of angles to radian measures and vice versa and apply to finding arc length	Example-3 -مثال+(3A,3B)	236
	تحويل قياسات الزوايا من الدرجات إلى الراديان والعكس بالعكس والتطبيق في إيجاد طول القوس	(18-25)	240

Identify all angles that are coterminal with the given angle. Then find and draw one positive and one negative angle coterminal with the given angle.

3A. -30°

3B. $\frac{3\pi}{4}$

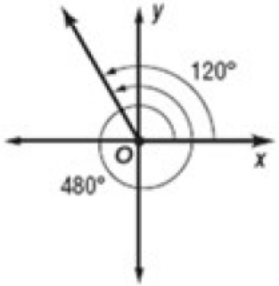
18. $120°$

SOLUTION:

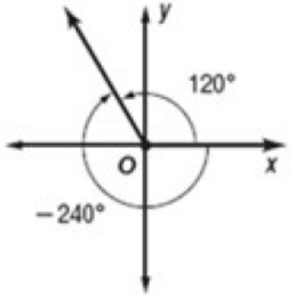
All angles measuring $120° + 360n°$ are coterminal with an $120°$ angle.

Sample answer: Let $n = 1$ and -1.

$120° + 360(1)° = 120° + 360°$ or $480°$



$120° + 360(-1)° = 120° - 360°$ or $-240°$



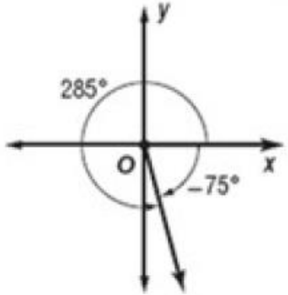
19. $-75°$

SOLUTION:

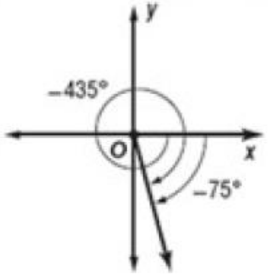
All angles measuring $-75° + 360n°$ are coterminal with a $-75°$ angle.

Sample answer: Let $n = 1$ and -1.

$-75° + 360(1)° = -75° + 360°$ or $285°$



$-75° + 360(-1)° = -75° - 360°$ or $-435°$



11	Convert degree measures of angles to radian measures and vice versa and apply to finding arc length	Example-3 -مثال+(3A,3B)	236
	تحويل قياسات الزوايا من الدرجات إلى الراديان والعكس بالعكس والتطبيق في إيجاد طول القوس	(18-25)	240

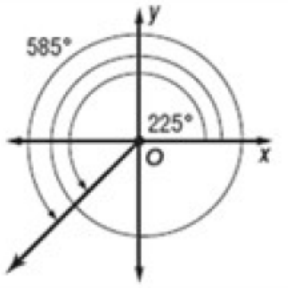
20. $225°$

SOLUTION:

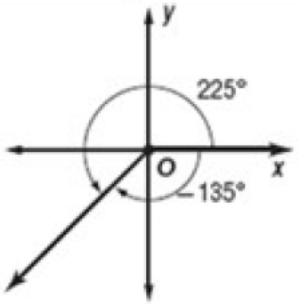
All angles measuring $225° + 360n°$ are coterminal with a $225°$ angle.

Sample answer: Let n = 1 and −1.

$225° + 360(1)° = 225° + 360°$ or $585°$



$225° + 360(-1)° = 225° - 360°$ or $-135°$



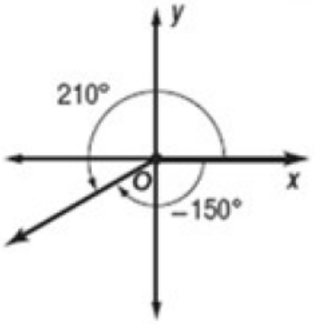
21. $-150°$

SOLUTION:

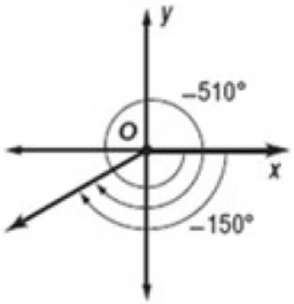
All angles measuring $-150° + 360n°$ are coterminal with a $-150°$ angle.

Sample answer: Let n = 1 and −1.

$-150° + 360(1)° = -150° + 360°$ or $210°$



$-150° + 360(-1)° = -150° - 360°$ or $-510°$



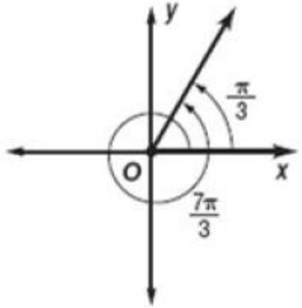
22. $\frac{\pi}{3}$

SOLUTION:

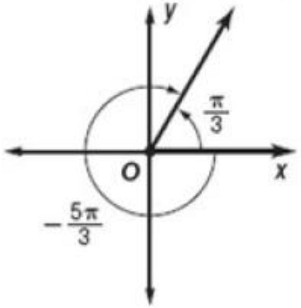
All angles measuring $\frac{\pi}{3} + 2n\pi$ are coterminal with a $\frac{\pi}{3}$ angle.

Sample answer: Let $n = 1$ and -1.

$$\frac{\pi}{3} + 2(1)\pi = \frac{\pi}{3} + 2\pi \text{ or } \frac{7\pi}{3}$$



$$\frac{\pi}{3} + 2(-1)\pi = \frac{\pi}{3} - 2\pi \text{ or } -\frac{5\pi}{3}$$



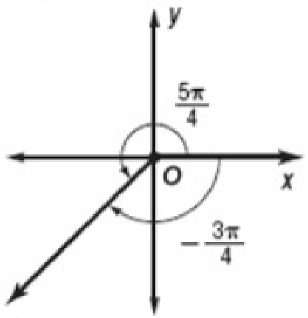
23. $-\frac{3\pi}{4}$

SOLUTION:

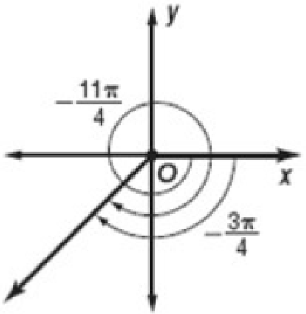
All angles measuring $-\frac{3\pi}{4} + 2n\pi$ are coterminal with a $-\frac{3\pi}{4}$ angle.

Sample answer: Let $n = 1$ and -1.

$$-\frac{3\pi}{4} + 2(1)\pi = -\frac{3\pi}{4} + 2\pi \text{ or } \frac{5\pi}{4}$$



$$-\frac{3\pi}{4} + 2(-1)\pi = -\frac{3\pi}{4} - 2\pi \text{ or } -\frac{11\pi}{4}$$



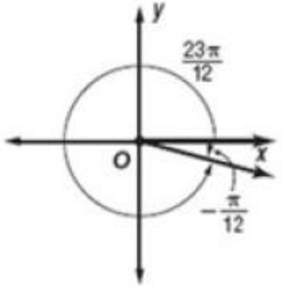
24. $-\frac{\pi}{12}$

SOLUTION:

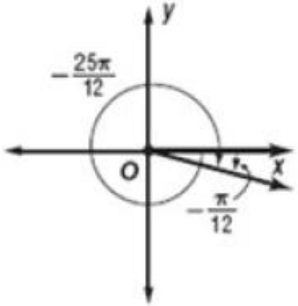
All angles measuring $-\frac{\pi}{12}+2n\pi$ are coterminal with a $-\frac{\pi}{12}$ angle.

Sample answer: Let $n = 1$ and -1.

$-\frac{\pi}{12}+2(1)\pi = -\frac{\pi}{12}+2\pi$ or $\frac{23\pi}{12}$



$-\frac{\pi}{12}+2(-1)\pi = -\frac{\pi}{12}-2\pi$ or $-\frac{25\pi}{12}$



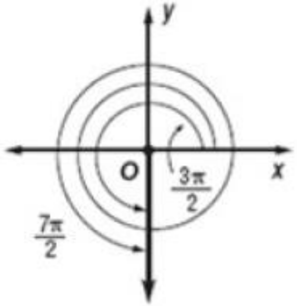
25. $\frac{3\pi}{2}$

SOLUTION:

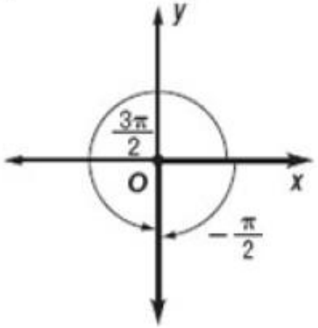
All angles measuring $\frac{3\pi}{2}+2n\pi$ are coterminal with a $\frac{3\pi}{2}$ angle.

Sample answer: Let $n = 1$ and -1.

$\frac{3\pi}{2}+2(1)\pi = \frac{3\pi}{2}+2\pi$ or $\frac{7\pi}{2}$



$\frac{3\pi}{2}+2(-1)\pi = \frac{3\pi}{2}-2\pi$ or $-\frac{\pi}{2}$



1. (3, 4)

ANSWER:

$\sin\theta = \frac{4}{5}$, $\cos\theta = \frac{3}{5}$, $\tan\theta = \frac{4}{3}$, $\csc\theta = \frac{5}{4}$, $\sec\theta = \frac{5}{3}$, $\cot\theta = \frac{3}{4}$

2. (−6, 6)

ANSWER:

$\sin\theta = \frac{\sqrt{2}}{2}, \cos\theta = -\frac{\sqrt{2}}{2}, \tan\theta = -1, \csc\theta = \sqrt{2}, \sec\theta = -\sqrt{2}, \cot\theta = -1$

3. (−4, −3)

ANSWER:

$\sin\theta = -\frac{3}{5}, \cos\theta = -\frac{4}{5}, \tan\theta = \frac{3}{4}, \csc\theta = -\frac{5}{3}, \sec\theta = -\frac{5}{4}, \cot\theta = \frac{4}{3}$

4. (2, 0)

ANSWER:

$\sin\theta = 0$, $\cos\theta = 1$, $\tan\theta = 0$, $\csc\theta$ is undefined, $\sec\theta = 1$, $\cot\theta$ is undefined.

5. (1, −8)

ANSWER:

$\sin\theta = -\frac{8\sqrt{65}}{65}, \cos\theta = \frac{\sqrt{65}}{65}, \tan\theta = -8, \csc\theta = -\frac{\sqrt{65}}{8}, \sec\theta = \sqrt{65}, \cot\theta = -\frac{1}{8}$

6. (5, −3)

ANSWER:

$\sin\theta = -\frac{3\sqrt{34}}{34}, \cos\theta = \frac{5\sqrt{34}}{34}, \tan\theta = -\frac{3}{5}, \csc\theta = -\frac{\sqrt{34}}{3}, \sec\theta = \frac{\sqrt{34}}{5}, \cot\theta = -\frac{5}{3}$

7. (−8, 15)

ANSWER:

$\sin\theta = \frac{15}{17}, \cos\theta = -\frac{8}{17}, \tan\theta = -\frac{15}{8}, \csc\theta = \frac{17}{15}, \sec\theta = -\frac{17}{8}, \cot\theta = -\frac{8}{15}$

8. (−1, −2)

ANSWER:

$\sin\theta = -\frac{2\sqrt{5}}{5}, \cos\theta = -\frac{\sqrt{5}}{5}, \tan\theta = 2, \csc\theta = -\frac{\sqrt{5}}{2}, \sec\theta = -\sqrt{5}, \cot\theta = \frac{1}{2}$

Find the exact value of each trigonometric function, if defined. If not defined, write *undefined*.

9. $\sin \frac{\pi}{2}$

ANSWER:
1

10. $\tan 2\pi$

ANSWER:
0

11. $\cot(-180°)$

ANSWER:
undefined

12. $\csc 270°$

ANSWER:
-1

13. $\cos(-270°)$

ANSWER:
0

14. $\sec 180°$

ANSWER:
-1

15. $\tan \pi$

ANSWER:
0

16. $\sec\left(-\frac{\pi}{2}\right)$

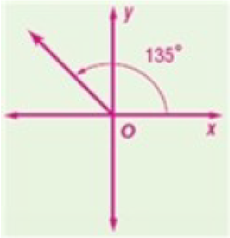
ANSWER:
undefined

Sketch each angle. Then find its reference angle.

17. $135°$

ANSWER:

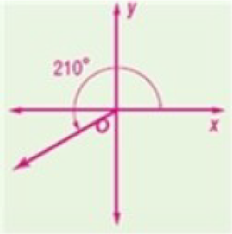
$45°$



18. $210°$

ANSWER:

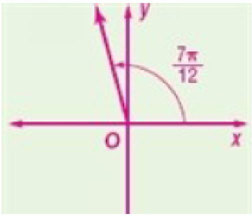
$30°$



19. $\frac{7\pi}{12}$

ANSWER:

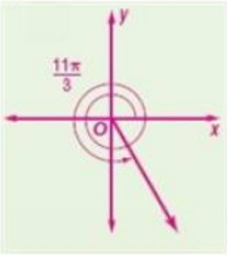
$\frac{5\pi}{12}$



20. $\frac{11\pi}{3}$

ANSWER:

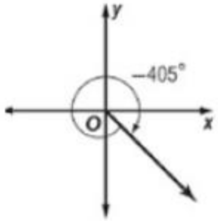
$\frac{\pi}{3}$



21. $-405°$

ANSWER:

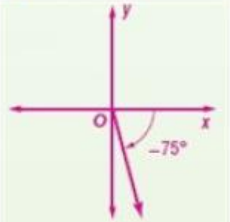
$45°$



22. $-75°$

ANSWER:

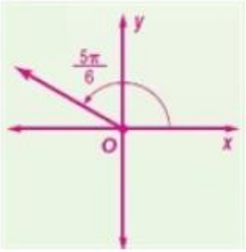
$75°$



23. $\frac{5\pi}{6}$

ANSWER:

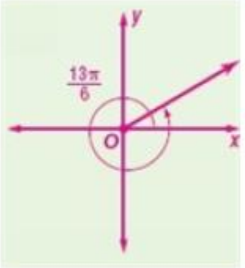
$\frac{\pi}{6}$



24. $\frac{13\pi}{6}$

ANSWER:

$\frac{\pi}{6}$



Find the exact value of each expression.

25. $\cos \frac{4\pi}{3}$

ANSWER:

$-\frac{1}{2}$

26. $\tan \frac{7\pi}{6}$

ANSWER:

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

27. $\sin \frac{3\pi}{4}$

ANSWER:

$\frac{\sqrt{2}}{2}$

28. $\cot (-45°)$

ANSWER:

-1

29. $\csc 390°$

ANSWER:

2

30. $\sec (-150°)$

ANSWER:

$-\frac{2\sqrt{3}}{3}$

31. $\tan \frac{11\pi}{6}$

ANSWER:

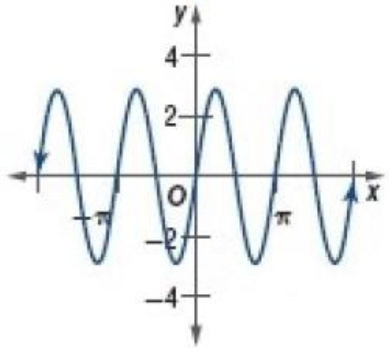
$-\frac{\sqrt{3}}{3}$

32. $\sin 300°$

ANSWER:

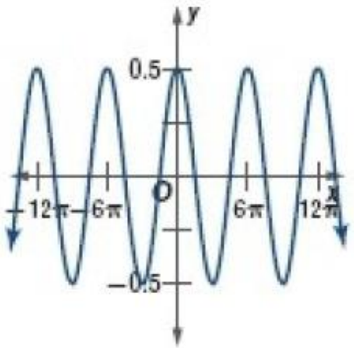
$-\frac{\sqrt{3}}{2}$

Write an equation that corresponds to each graph.

31. 

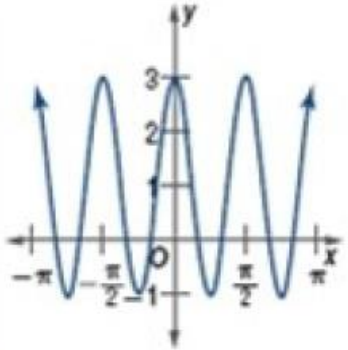
ANSWER:

Sample answer: $y = 3 \sin 2x$

32. 

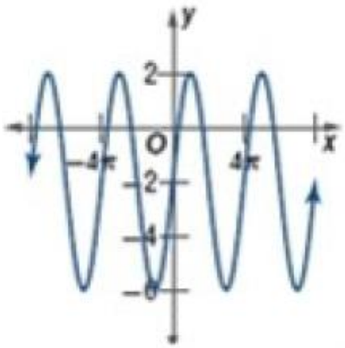
ANSWER:

Sample answer: $y = \frac{1}{2} \cos \frac{x}{3}$

33. 

ANSWER:

Sample answer: $y = 2 \cos 4x + 1$

34. 

ANSWER:

Sample answer: $y = 4 \sin \frac{x}{2} - 2$

6A. $\tan\left(\tan^{-1}\frac{\pi}{3}\right)$

6B. $\cos^{-1}\left(\cos\frac{3\pi}{4}\right)$

6C. $\arcsin\left(\sin\frac{2\pi}{3}\right)$

Find the exact value of each expression.

7A. $\cos^{-1}\left(\sin\frac{\pi}{3}\right)$

7B. $\sin\left(\arctan\frac{5}{12}\right)$

Find the exact value of each expression, if it exists.
(Examples 6 and 7)

29. $\sin\left(\sin^{-1}\frac{3}{4}\right)$

30. $\sin^{-1}\left(\sin\frac{\pi}{2}\right)$

31. $\cos\left(\cos^{-1}\frac{2}{9}\right)$

32. $\cos^{-1}(\cos\pi)$

33. $\tan\left(\tan^{-1}\frac{\pi}{4}\right)$

34. $\tan^{-1}\left(\tan\frac{\pi}{3}\right)$

35. $\cos(\tan^{-1}1)$

36. $\sin^{-1}\left(\cos\frac{\pi}{2}\right)$

37. $\sin\left(2\cos^{-1}\frac{\sqrt{2}}{2}\right)$

38. $\sin(\tan^{-1}1-\sin^{-1}1)$

39. $\cos(\tan^{-1}1-\sin^{-1}1)$

40. $\cos\left(\cos^{-1}0+\sin^{-1}\frac{1}{2}\right)$

Rewrite as an expression that does not involve a fraction.

7A. $\dfrac{\cos^2 x}{1-\sin x}$

7B. $\dfrac{4}{\sec x+\tan x}$

Rewrite as an expression that does not involve a fraction.

38. $\dfrac{\sin x}{\csc x-\cot x}$

SOLUTION:

$$\begin{aligned}\frac{\sin x}{\csc x-\cot x}&=\frac{\sin x}{\csc x-\cot x}\cdot\frac{\csc x+\cot x}{\csc x+\cot x}\\&=\frac{\sin x(\csc x+\cot x)}{(\csc x-\cot x)(\csc x+\cot x)}\\&=\frac{\sin x\csc x+\sin x\cot x}{(\csc x-\cot x)(\csc x+\cot x)}\\&=\frac{\sin x\dfrac{1}{\sin x}+\sin x\dfrac{\cos x}{\sin x}}{\csc^2 x-\cot^2 x}\\&=\frac{1+\cos x}{1}\\&=1+\cos x\end{aligned}$$

39. $\dfrac{\csc x}{1-\sin x}$

SOLUTION:

$$\begin{aligned}\frac{\csc x}{1-\sin x}&=\frac{\csc x}{1-\sin x}\cdot\frac{1+\sin x}{1+\sin x}\\&=\frac{\csc x(1+\sin x)}{(1-\sin x)(1+\sin x)}\\&=\frac{\csc x+\csc x\sin x}{1-\sin^2 x}\\&=\frac{\csc x+\dfrac{1}{\sin x}\sin x}{1-\sin^2 x}\\&=\frac{\csc x+1}{\cos^2 x}\\&=\frac{1}{\cos^2 x}\cdot\frac{\csc x+1}{1}\\&=\sec^2 x\cdot\frac{\csc x+1}{1}\\&=\sec^2 x(\csc x+1)\end{aligned}$$

40. $\dfrac{\cot x}{\sec x-\tan x}$

SOLUTION:

$$\begin{aligned}\frac{\cot x}{\sec x-\tan x}&=\frac{\cot x}{\sec x-\tan x}\cdot\frac{\sec x+\tan x}{\sec x+\tan x}\\&=\frac{\cot x(\sec x+\tan x)}{(\sec x-\tan x)(\sec x+\tan x)}\\&=\frac{\cot x\sec x+\cot x\tan x}{\sec^2 x-\tan^2 x}\\&=\frac{\dfrac{\cos x}{\sin x}\cdot\dfrac{1}{\cos x}+\dfrac{1}{\tan x}\tan x}{1}\\&=\frac{1}{\sin x}+1\\&=\csc x+1\end{aligned}$$

41. $\dfrac{\cot x}{1+\sin x}$

SOLUTION:

$$\begin{aligned}
\frac{\cot x}{1+\sin x} &= \frac{\cot x}{1+\sin x}\cdot\frac{1-\sin x}{1-\sin x}\\
&= \frac{\cot x(1-\sin x)}{(1+\sin x)(1-\sin x)}\\
&= \frac{\cot x(1-\sin x)}{1-\sin^2 x}\\
&= \frac{\cot x(1-\sin x)}{\cos^2 x}\\
&= \frac{\cot x}{\cos^2 x}(1-\sin x)\\
&= \frac{\cos x}{\sin x}\cdot\frac{1}{\cos^2 x}(1-\sin x)\\
&= \frac{1}{\sin x\cos x}(1-\sin x)\\
&= \frac{1}{\sin x\cos x}-\frac{\sin x}{\sin x\cos x}\\
&= \frac{1}{\sin x}\cdot\frac{1}{\cos x}-\frac{1}{\cos x}\\
&= \csc x\sec x-\sec x\\
&= \sec x(\csc x-1)
\end{aligned}$$

42. $\dfrac{3\tan x}{1-\cos x}$

SOLUTION:

$$\begin{aligned}
\frac{3\tan x}{1-\cos x} &= \frac{3\tan x}{1-\cos x}\cdot\frac{1+\cos x}{1+\cos x}\\
&= \frac{3\tan x(1+\cos x)}{(1-\cos x)(1+\cos x)}\\
&= \frac{3\tan x+3\tan x\cos x}{1-\cos^2 x}\\
&= \frac{3\tan x+3\tan x\cos x}{\sin^2 x}\\
&= \frac{3\tan x}{\sin^2 x}+\frac{3\tan x\cos x}{\sin^2 x}\\
&= 3\tan x\frac{1}{\sin^2 x}+3\tan x\frac{\cos x}{\sin^2 x}\\
&= 3\cdot\frac{\sin x}{\cos x}\cdot\frac{1}{\sin^2 x}+3\cdot\frac{\sin x}{\cos x}\cdot\frac{\cos x}{\sin^2 x}\\
&= 3\cdot\frac{1}{\cos x}\cdot\frac{1}{\sin x}+\frac{3}{\sin x}\\
&= 3\sec x\csc x+3\csc x\\
&= 3\csc x(\sec x+1)
\end{aligned}$$

43. $\dfrac{2\sin x}{\cot x+\csc x}$

SOLUTION:

$$\begin{aligned}
\frac{2\sin x}{\cot x+\csc x} &= \frac{2\sin x}{\cot x+\csc x}\cdot\frac{\cot x-\csc x}{\cot x-\csc x}\\
&= \frac{2\sin x(\cot x-\csc x)}{(\cot x+\csc x)(\cot x-\csc x)}\\
&= \frac{2\sin x\cot x-2\sin x\csc x}{\cot^2 x-\csc^2 x}\\
&= \frac{2\sin x\cot x-2\sin x\csc x}{-1}\\
&= -2\sin x\cot x+2\sin x\csc x\\
&= -2\sin x\frac{\cos x}{\sin x}+2\sin x\frac{1}{\sin x}\\
&= -2\cos x+2\\
&= 2-2\cos x
\end{aligned}$$

44. $\dfrac{\sin x}{1-\sec x}$

SOLUTION:

$$\begin{aligned}
\frac{\sin x}{1-\sec x} &= \frac{\sin x}{1-\sec x}\cdot\frac{1+\sec x}{1+\sec x}\\
&= \frac{\sin x}{1-\sec x}\cdot\frac{1+\sec x}{1+\sec x}\\
&= \frac{\sin x(1+\sec x)}{(1-\sec x)(1+\sec x)}\\
&= \frac{\sin x+\sin x\sec x}{1-\sec^2 x}\\
&= \frac{\sin x+\sin x\sec x}{-(\sec^2 x-1)}\\
&= \frac{\sin x+\sin x\sec x}{-\tan^2 x}\\
&= \frac{\sin x}{-\tan^2 x}+\frac{\sin x\sec x}{-\tan^2 x}\\
&= \frac{\sin x}{-\frac{\sin^2 x}{\cos^2 x}}+\frac{\sin x\sec x}{-\frac{\sin^2 x}{\cos^2 x}}\\
&= \sin x\cdot\left(-\frac{\cos^2 x}{\sin^2 x}\right)+\sin x\frac{1}{\cos x}\left(-\frac{\cos^2 x}{\sin^2 x}\right)\\
&= -\frac{\cos^2 x}{\sin x}+\left(-\frac{\cos x}{\sin x}\right)\\
&= \frac{-\cos^2 x-\cos x}{\sin x}\\
&= \frac{-\cos x(\cos x+1)}{\sin x}\\
&= -\cot x(\cos x+1)
\end{aligned}$$

45. $\dfrac{\cot^2 x\cos x}{\csc x-1}$

SOLUTION:

$$\begin{aligned}
\frac{\cot^2 x\cos x}{\csc x-1} &= \frac{\cot^2 x\cos x}{\csc x-1}\cdot\frac{\csc x+1}{\csc x+1}\\
&= \frac{\cot^2 x\cos x(\csc x+1)}{(\csc x-1)(\csc x+1)}\\
&= \frac{\cot^2 x\cos x(\csc x+1)}{\csc^2 x-1}\\
&= \frac{\cot^2 x\cos x(\csc x+1)}{\cot^2 x}\\
&= \cos x(\csc x+1)
\end{aligned}$$

46. $\dfrac{5}{\sec x+1}$

SOLUTION:

$$\begin{aligned}
\frac{5}{\sec x+1} &= \frac{5}{\sec x+1}\cdot\frac{\sec x-1}{\sec x-1}\\
&= \frac{5(\sec x-1)}{(\sec x+1)(\sec x-1)}\\
&= \frac{5(\sec x-1)}{\sec^2 x-1}\\
&= \frac{5(\sec x-1)}{\tan^2 x}\\
&= \frac{1}{\tan^2 x}\cdot 5(\sec x-1)\\
&= 5\cot^2 x(\sec x-1)
\end{aligned}$$

47. $\dfrac{\sin x \tan x}{\cos x + 1}$

SOLUTION:

$$
\begin{aligned}
\frac{\sin x \tan x}{\cos x+1} &= \frac{\sin x \tan x}{\cos x+1}\cdot\frac{\cos x-1}{\cos x-1}\\
&= \frac{\sin x \tan x(\cos x-1)}{(\cos x+1)(\cos x-1)}\\
&= \frac{\sin x \tan x(\cos x-1)}{\cos^2 x-1}\\
&= \frac{\sin x \tan x(\cos x-1)}{-(1-\cos^2 x)}\\
&= \frac{\sin x \tan x(\cos x-1)}{-(\sin^2 x)}\\
&= \frac{\tan x(\cos x-1)}{-\sin x}\\
&= -\frac{\sin x}{\cos x}\cdot\frac{\cos x-1}{\sin x}\\
&= -\frac{\cos x-1}{\cos x}\\
&= \frac{1-\cos x}{\cos x}\\
&= \frac{1}{\cos x}-\frac{\cos x}{\cos x}\\
&= \sec x-1
\end{aligned}
$$

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1.

SOLUTION:

$$(f+g)(x)=x^2+\sqrt{x}+4$$
$$(f-g)(x)=x^2-\sqrt{x}+4$$
$$(f\cdot g)(x)=(x^2+4)(\sqrt{x})$$
$$=x^2\sqrt{x}+4\sqrt{x}$$
$$=x^{\frac{5}{2}}+4x^{\frac{1}{2}}$$
$$\left(\frac{f}{g}\right)(x)=\frac{x^2+4}{\sqrt{x}}$$

D = $[0, \infty)$ for all of the functions except $\left(\frac{f}{g}\right)(x)$, for which $D=(0,\infty)$.

ANSWER:

$(f+g)(x)=x^2+\sqrt{x}+4$; $D=[0,\infty)$; $(f-g)(x)=x^2-\sqrt{x}+4$; $D=[0,\infty)$; $(f\cdot g)(x)=x^{\frac{5}{2}}+4x^{\frac{1}{2}}$; $D=[0,\infty)$; $\left(\frac{f}{g}\right)(x)=\frac{x^2+4}{\sqrt{x}}$; $D=(0,\infty)$

2.

SOLUTION:

$$(f+g)(x)=-x^3+x+5$$
$$(f-g)(x)=8-x^3-(x-3)$$
$$=-x^3-x+11$$
$$(f\cdot g)(x)=(8-x^3)(x-3)$$
$$=-x^4+3x^3+8x-24$$
$$\left(\frac{f}{g}\right)(x)=\frac{8-x^3}{x-3}$$

D = $(-\infty,\infty)$ for all of the functions except $\left(\frac{f}{g}\right)(x)$, for which $D=(-\infty,3)\cup(3,\infty)$.

ANSWER:

$(f+g)(x)=-x^3+x+5$; $D=(-\infty,\infty)$; $(f-g)(x)=-x^3-x+11$; $D=(-\infty,\infty)$; $(f\cdot g)(x)=-x^4+3x^3+8x-24$; $D=(-\infty,\infty)$; $\left(\frac{f}{g}\right)(x)=\frac{8-x^3}{x-3}$;

$D=(-\infty,3)\cup(3,\infty)$

3.

SOLUTION:

$$(f+g)(x)=x^2+6x+8$$
$$(f-g)(x)=x^2+5x+6-(x+2)$$
$$=x^2+4x+4$$
$$(f\cdot g)(x)=(x^2+5x+6)(x+2)$$
$$=x^3+2x^2+5x^2+10x+6x+12$$
$$=x^3+7x^2+16x+12$$
$$\left(\frac{f}{g}\right)(x)=\frac{x^2+5x+6}{x+2}$$
$$=\frac{(x+3)(x+2)}{x+2}$$
$$=x+3$$

D = $(-\infty,\infty)$ for all of the functions except $\left(\frac{f}{g}\right)(x)$, for which $D=(-\infty,-2)\cup(-2,\infty)$. For this function, we need to remember that we factored the $x+2$ out of the denominator.

ANSWER:

$(f+g)(x)=x^2+6x+8$; $D=(-\infty,\infty)$; $(f-g)(x)=x^2+4x+4$; $D=(-\infty,\infty)$; $(f\cdot g)(x)=x^3+7x^2+16x+12$; $D=(-\infty,\infty)$; $\left(\frac{f}{g}\right)(x)=x+3$;

$D=(-\infty,-2)\cup(-2,\infty)$

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4.

SOLUTION:

$$(f+g)(x) = 2x - 4$$
$$(f-g)(x) = x - 9 - (x+5) = -14$$
$$(f\cdot g)(x) = (x-9)(x+5) = x^2 - 4x - 45$$
$$\left(\frac{f}{g}\right)(x) = \frac{x-9}{x+5}$$

D = $(-\infty, \infty)$ for all of the functions except $\left(\frac{f}{g}\right)(x)$, for which $D = (-\infty, -5) \cup (-5, \infty)$.

ANSWER:

$(f+g)(x) = 2x - 4$; D = $(-\infty, \infty)$; $(f-g)(x) = -14$; D = $(-\infty, \infty)$; $(f\cdot g)(x) = x^2 - 4x - 45$; D = $(-\infty, \infty)$; $\left(\frac{f}{g}\right)(x) = \frac{x-9}{x+5}$; $D = (-\infty, -5) \cup (-5, \infty)$

5.

SOLUTION:

$$(f+g)(x) = x^2 + 10x$$
$$(f-g)(x) = x^2 + x - (9x) = x^2 - 8x$$
$$(f\cdot g)(x) = (x^2 + x)(9x) = 9x^3 + 9x^2$$
$$\left(\frac{f}{g}\right)(x) = \frac{x^2 + x}{9x} = \frac{x(x+1)}{x(9)} = \frac{x+1}{9}$$

D = $(-\infty, \infty)$ for all of the functions except $\left(\frac{f}{g}\right)(x)$, for which $D = (-\infty, 0) \cup (0, \infty)$. Even though there appears to be no restriction in the simplified function, there is in the original.

ANSWER:

$(f+g)(x) = x^2 + 10x$; D = $(-\infty, \infty)$; $(f-g)(x) = x^2 - 8x$; D = $(-\infty, \infty)$; $(f\cdot g)(x) = 9x^3 + 9x^2$; D = $(-\infty, \infty)$; $\left(\frac{f}{g}\right)(x) = \frac{x+1}{9}$; $D = (-\infty, 0) \cup (0, \infty)$

6.

SOLUTION:

$$(f+g)(x) = x - 7 + x + 7 = 2x$$
$$(f-g)(x) = x - 7 - (x+7) = -14$$
$$(f\cdot g)(x) = (x-7)(x+7) = x^2 - 49$$
$$\left(\frac{f}{g}\right)(x) = \frac{x-7}{x+7}$$

D = $(-\infty, \infty)$ for all of the functions except $\left(\frac{f}{g}\right)(x)$, for which $D = (-\infty, -7) \cup (-7, \infty)$.

ANSWER:

$(f+g)(x) = 2x$; D = $(-\infty, \infty)$; $(f-g)(x) = -14$; D = $(-\infty, \infty)$; $(f\cdot g)(x) = x^2 - 49$; D = $(-\infty, \infty)$; $\left(\frac{f}{g}\right)(x) = \frac{x-7}{x+7}$; $D = (-\infty, -7) \cup (-7, \infty)$

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7.

SOLUTION:

$$(f+g)(x)=x^3+x+\frac{6}{x}$$

$$(f-g)(x)=-x^3-x+\frac{6}{x}$$

$$(f\cdot g)(x)=\left(\frac{6}{x}\right)(x^3+x)=\frac{6x^3+6x}{x}=6x^2+6$$

$$\left(\frac{f}{g}\right)(x)=\frac{\frac{6}{x}}{x^3+x}=\frac{6}{x\left(x^3+x\right)}=\frac{6}{x^4+x^2}$$

$D=(-\infty,0)\cup(0,\infty)$ for all functions. Even though there appears to be no restriction in the simplified function $(f\cdot g)(x)$, there is in the original.

ANSWER:

$(f+g)(x)=x^3+x+\frac{6}{x}$; $D=(-\infty,0)\cup(0,\infty)$; $(f-g)(x)=-x^3-x+\frac{6}{x}$; $D=(-\infty,0)\cup(0,\infty)$; $(f\cdot g)(x)=6x^2+6$; $D=(-\infty,0)\cup(0,\infty)$; $\left(\frac{f}{g}\right)(x)=\frac{6}{x^4+x^2}$; $D=(-\infty,0)\cup(0,\infty)$

8.

SOLUTION:

$$(f+g)(x)=\frac{x}{4}+\frac{3}{x}=\frac{x^2}{4x}+\frac{12}{4x}=\frac{x^2+12}{4x}$$

$$(f-g)(x)=\frac{x}{4}-\frac{3}{x}=\frac{x^2}{4x}-\frac{12}{4x}=\frac{x^2-12}{4x}$$

$$(f\cdot g)(x)=\left(\frac{x}{4}\right)\left(\frac{3}{x}\right)=\frac{3}{4}$$

$$\left(\frac{f}{g}\right)(x)=\frac{\frac{x}{4}}{\frac{3}{x}}=\left(\frac{x}{4}\right)\left(\frac{x}{3}\right)=\frac{x^2}{12}$$

$D=(-\infty,0)\cup(0,\infty)$ for all of these functions. Even though there appears to be no restriction in the simplified function $(f\cdot g)(x)$ or $\left(\frac{f}{g}\right)(x)$, there is in the originals.

9.

SOLUTION:

$$(f+g)(x)=\frac{1}{\sqrt{x}}+4\sqrt{x}$$

$$(f-g)(x)=\frac{1}{\sqrt{x}}-4\sqrt{x}$$

$$(f\cdot g)(x)=\left(\frac{1}{\sqrt{x}}\right)4\sqrt{x}=4$$

$$\left(\frac{f}{g}\right)(x)=\frac{\frac{1}{\sqrt{x}}}{4\sqrt{x}}=\frac{1}{\sqrt{x}}\cdot\frac{1}{4\sqrt{x}}=\frac{1}{4x}$$

$D=(0,\infty)$ for all of these functions. Even though there appears to be no restriction in the simplified function $(f\cdot g)(x)$, there is in the original.

ANSWER:

$(f+g)(x)=\frac{1}{\sqrt{x}}+4\sqrt{x}$; $D=(0,\infty)$; $(f-g)(x)=\frac{1}{\sqrt{x}}-4\sqrt{x}$; $D=(0,\infty)$; $(f\cdot g)(x)=4$; $D=(0,\infty)$; $\left(\frac{f}{g}\right)(x)=\frac{1}{4x}$; $(0,\infty)$

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10. *SOLUTION:*

$$(f+g)(x) = x^4 + \frac{3}{x}$$

$$(f-g)(x) = \frac{3}{x} - x^4$$

$$(f \cdot g)(x) = \left(\frac{3}{x}\right)x^4 = 3x^3$$

$$\left(\frac{f}{g}\right)(x) = \frac{\frac{3}{x}}{x^4} = \frac{3}{x} \cdot \frac{1}{x^4} = \frac{3}{x^5}$$

$D = (-\infty, 0) \cup (0, \infty)$ for all of these functions. Even though there appears to be no restriction in the simplified function $(f \cdot g)(x)$, there is in the original.

ANSWER:

$(f+g)(x) = \frac{3}{x} + x^4$; $D = (-\infty, 0) \cup (0, \infty)$; $(f-g)(x) = \frac{3}{x} - x^4$; $D = (-\infty, 0) \cup (0, \infty)$; $(f \cdot g)(x) = 3x^3$; $D = (-\infty, 0) \cup (0, \infty)$; $\left(\frac{f}{g}\right)(x) = \frac{3}{x^5}$; $D = (-\infty, 0) \cup (0, \infty)$

11. *SOLUTION:*

$$(f+g)(x) = \sqrt{x+8} + \sqrt{x+5} - 3$$

$$(f-g)(x) = \sqrt{x+8} - \sqrt{x+5} + 3$$

$$(f \cdot g)(x) = \left(\sqrt{x+8}\right)\left(\sqrt{x+5} - 3\right) = \sqrt{x^2+13x+40} - 3\sqrt{x+8}$$

$$\left(\frac{f}{g}\right)(x) = \frac{\sqrt{x+8}}{\sqrt{x+5}-3} = \frac{\sqrt{x+8}}{\sqrt{x+5}-3} \cdot \frac{\sqrt{x+5}+3}{\sqrt{x+5}+3} = \frac{\sqrt{x^2+13x+40}+3\sqrt{x+8}}{x+5-9} = \frac{\sqrt{x^2+13x+40}+3\sqrt{x+8}}{x-4}$$

For $(f+g)(x)$, $(f-g)(x)$, and $(f \cdot g)(x)$, $D = [-5, \infty)$. For $\left(\frac{f}{g}\right)(x)$, $D = [-5, 4) \cup (4, \infty)$

ANSWER:

$(f+g)(x) = \sqrt{x+8} + \sqrt{x+5} - 3$; $D = [-5, \infty)$; $(f-g)(x) = \sqrt{x+8} - \sqrt{x+5} + 3$; $D = [-5, \infty)$; $(f \cdot g)(x) = \sqrt{x^2+13x+40} - 3\sqrt{x+8}$; $D = [-5, \infty)$; $\left(\frac{f}{g}\right)(x) = \frac{\sqrt{x^2+13x+40}+3\sqrt{x+8}}{x-4}$; $D = [-5, 4) \cup (4, \infty)$

12. *SOLUTION:*

$$(f+g)(x) = \sqrt{x+6} + \sqrt{x-4}$$

$$(f-g)(x) = \sqrt{x+6} - \sqrt{x-4}$$

$$(f \cdot g)(x) = \left(\sqrt{x+6}\right)\left(\sqrt{x-4}\right) = \sqrt{x^2+2x-24}$$

$$\left(\frac{f}{g}\right)(x) = \frac{\sqrt{x+6}}{\sqrt{x-4}} = \frac{\sqrt{x+6}}{\sqrt{x-4}} \cdot \frac{\sqrt{x-4}}{\sqrt{x-4}} = \frac{\sqrt{x^2+2x-24}}{x-4}$$

For $(f+g)(x)$, $(f-g)(x)$, and $(f \cdot g)(x)$, $D = [4, \infty)$. For $\left(\frac{f}{g}\right)(x)$, $D = (4, \infty)$.

ANSWER:

$(f+g)(x) = \sqrt{x+6} + \sqrt{x-4}$; $D = [4, \infty)$; $(f-g)(x) = \sqrt{x+6} - \sqrt{x-4}$; $D = [4, \infty)$; $(f \cdot g)(x) = \sqrt{x^2+2x-24}$; $D = [4, \infty)$; $\left(\frac{f}{g}\right)(x) = \frac{\sqrt{x^2+2x-24}}{x-4}$; $D = (4, \infty)$

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30.

ANSWER:

Sample answer: $f(x) = \sqrt{x} + 7$; $g(x) = 4x + 2$

31.

ANSWER:

Sample answer: $f(x) = \frac{6}{x} - 8$; $g(x) = x + 5$

32.

ANSWER:

Sample answer: $f(x) = |x| - 9$; $g(x) = 4x + 8$

33.

ANSWER:

Sample answer: $f(x) = [[-3x]]$; $g(x) = x - 9$

34.

ANSWER:

Sample answer: $f(x) = \sqrt{x}$; $g(x) = \frac{5-x}{x+2}$

35.

ANSWER:

Sample answer: $f(x) = x^3$; $g(x) = \sqrt{x} + 4$

36.

ANSWER:

Sample answer: $f(x) = \frac{6}{x^2}$; $g(x) = x + 2$

37.

ANSWER:

Sample answer: $f(x) = \frac{8}{x^2}$; $g(x) = x - 5$

38.

ANSWER:

Sample answer: $f(x) = \frac{\sqrt{x}}{x - 6}$; $g(x) = x + 4$

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39.

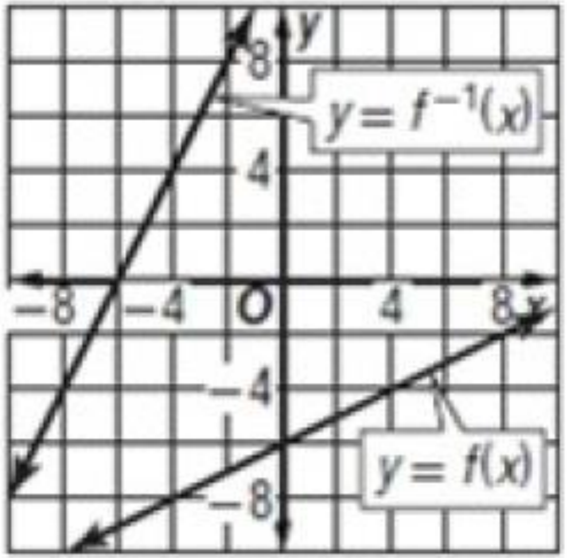
ANSWER:

Sample answer: $f(x) = \dfrac{x+6}{\sqrt{x}}$; $g(x) = x - 1$

16	a) Perform operations with functions	Example-1 -مثال	57
	إجراء العمليات على الدوال	(1-12)	61
	b) Find compositions of functions	Example-4 -مثال+(4A,4B)	60
	إيجاد تركيب الدوال	(30-39)	61
	c) Find inverse functions algebraically and graphically	Example-4 -مثال + (4A,4B)	68 & 69
	إيجاد الدوال العكسية جبريًا وبيانيًا	(38-43)	70

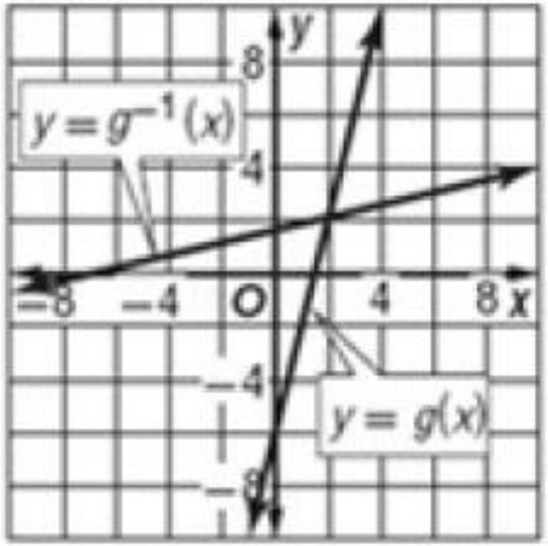
38.

ANSWER:



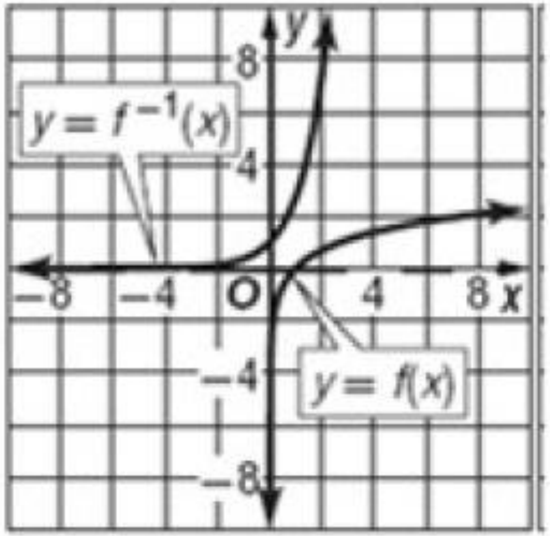
39.

ANSWER:



40.

ANSWER:



16	a) Perform operations with functions	Example-1 -مثال	57
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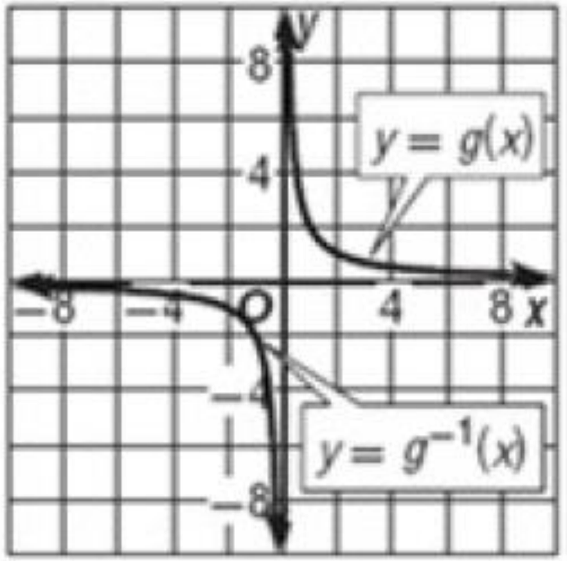
	إيجاد الدوال العكسية جبريًا وبيانيًا	(38-43)	70

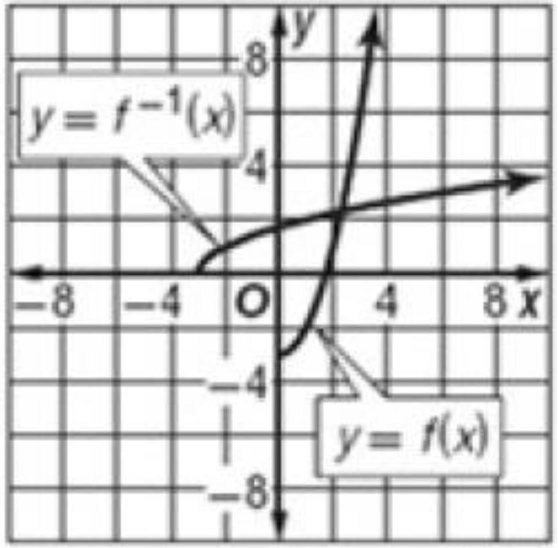
41.

ANSWER:



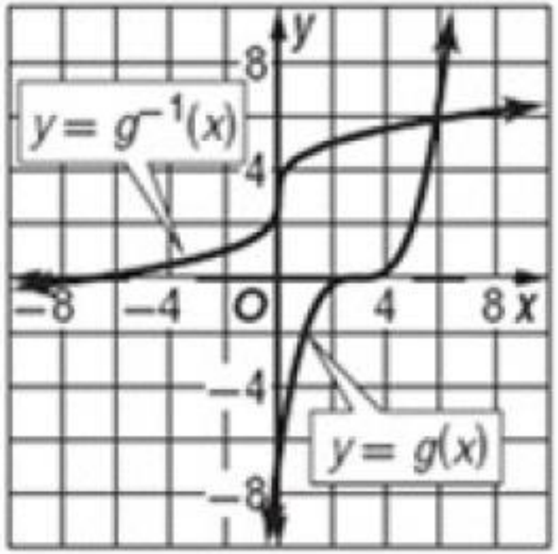
42.

ANSWER:



43.

ANSWER:



Write a polynomial function of least degree with real coefficients in standard form with the given zeros.

6A. -3, 1 (multiplicity: 2), $4i$

6B. $2\sqrt{3}, -2\sqrt{3}, 1 + i$

32. 3, –4, 6, –1

ANSWER:

Sample answer: $f(x) = x^4 - 4x^3 - 23x^2 + 54x + 72$

33. –2, –4, –3, 5

ANSWER:

Sample answer: $f(x) = x^4 + 4x^3 - 19x^2 - 106x - 120$

34. $-5, 3, 4 + i$

ANSWER:

Sample answer: $f(x) = x^4 - 6x^3 - 14x^2 + 154x - 255$

35. $-1, 8, 6 - i$

ANSWER:

Sample answer: $f(x) = x^4 - 19x^3 + 113x^2 - 163x - 296$

36. $2\sqrt{5}, -2\sqrt{5}, -3, 7$

ANSWER:

Sample answer: $f(x) = x^4 - 4x^3 - 41x^2 + 80x + 420$

37. $-5, 2, 4 - \sqrt{3}, 4 + \sqrt{3}$

ANSWER:

Sample answer: $f(x) = x^4 - 5x^3 - 21x^2 + 119x - 130$

38. $\sqrt{7}, -\sqrt{7}, 4i$

ANSWER:

Sample answer: $f(x) = x^4 + 9x^2 - 112$

39. $\sqrt{6}, -\sqrt{6}, 3 - 4i$

ANSWER:

Sample answer: $f(x) = x^4 - 6x^3 + 19x^2 + 36x - 150$

40. $2 + \sqrt{3}, 2 - \sqrt{3}, 4 + 5i$

ANSWER:

Sample answer: $f(x) = x^4 - 12x^3 + 74x^2 - 172x + 41$

41. $6 - \sqrt{5}, 6 + \sqrt{5}, 8 - 3i$

ANSWER:

Sample answer: $f(x) = x^4 - 28x^3 + 296x^2 - 1372x + 2263$

18	Solve problems involving exponential growth and decay	Example -5-مثال+(5)	163
	حل مسائل تتضمن نموًا وتضاءلًا أسيين	(21-26)(Continuously parts-أجزاء المستمرة)	166
	Apply the One -to -One Property of Exponential Functions to solve equations	Example-1 -مثال 1+(1A,1B)	190
	تطبيق خاصية واحد لواحد للدوال الأسية لحل المعادلات	(1-10)	196

FINANCIAL LITERACY Suppose Mariam finds an account that will allow her to invest her AED 300 at a 6% interest rate compounded continuously. If there are no other deposits or withdrawals, what will Mariam's account balance be after 20 years?

21. $P = \$500$, $r = 3\%$, $t = 5$ years

ANSWER:

n	1	4	12	365	continuously
A	$579.64	$580.59	$580.81	$580.91	$580.92

22. $P = \$1000$, $r = 4.5\%$, $t = 10$ years

ANSWER:

n	1	4	12	365	continuously
A	$1552.97	$1564.38	$1566.99	$1568.27	$1568.31

23. $P = \$1000$, $r = 5\%$, $t = 20$ years

ANSWER:

n	1	4	12	365	continuously
A	$2653.30	$2701.48	$2712.64	$2718.10	$2718.28

24. $P = \$5000$, $r = 6\%$, $t = 30$ years

ANSWER:

n	1	4	12	365	continuously
A	$28,717.46	$29,846.61	$30,112.88	$30,243.76	$30,248.24

18	Solve problems involving exponential growth and decay	Example -5-مثال+(5)	163
	حل مسائل تتضمن نموًا وتضاءلًا أسيين	(21-26)(Continuously parts-أجزاء المستمرة)	166
	Apply the One -to -One Property of Exponential Functions to solve equations	Example-1 -مثال+(1A,1B)	190
	تطبيق خاصية واحد لواحد للدوال الأسية لحل المعادلات	(1-10)	196

25. **FINANCIAL LITERACY** Brady acquired an inheritance of \$20,000 at age 8, but he will not have access to it until he turns 18.

a. If his inheritance is placed in a savings account earning 4.6% interest compounded monthly, how much will Brady's inheritance be worth on his 18th birthday?

b. How much will Brady's inheritance be worth if it is placed in an account earning 4.2% interest compounded continuously?

ANSWER:

a. \$31,653.63

b. \$30,439.23

26. **FINANCIAL LITERACY** Katrina invests \$1200 in a certificate of deposit (CD). The table shows the interest rates offered by the bank on 3- and 5-year CDs.

CD Offers		
Years	3	5
Interest	3.45%	4.75%
Compounded	continuously	monthly

a. How much would her investment be worth with each option?

b. How much would her investment be worth if the 5-year CD was compounded continuously?

ANSWER:

a. 3-year CD: \$1330.85, 5-year CD: \$1520.98

b. \$1521.69

18	Solve problems involving exponential growth and decay	Example -5-مثال+(5)	163
	حل مسائل تتضمن نموًا وتضاءلًا أسيين	(21-26)(Continuously parts-أجزاء المستمرة)	166
	Apply the One -to -One Property of Exponential Functions to solve equations	Example-1 -مثال+(1A,1B)	190
	تطبيق خاصية واحد لواحد للدوال الأسية لحل المعادلات	(1-10)	196

1A. $16^{x+3} = 4^{4x+7}$

1B. $\left(\frac{2}{3}\right)^{x-5} = \left(\frac{9}{4}\right)^{\frac{3x}{4}}$

1. $4^{x+7} = 8^{x+3}$

ANSWER:

5

2. $8^{x+4} = 32^{3x}$

ANSWER:

1

3. $49^{x+4} = 7^{18-x}$

ANSWER:

$\frac{10}{3}$

4. $32^{x-1} = 4^{x+5}$

ANSWER:

5

5. $\left(\frac{9}{16}\right)^{3x-2} = \left(\frac{3}{4}\right)^{5x+4}$

ANSWER:

8

6. $12^{3x+11} = 144^{2x+7}$

ANSWER:

-3

7. $25^{\frac{x}{3}} = 5^{x-4}$

ANSWER:

12

8. $\left(\frac{5}{6}\right)^{4x} = \left(\frac{36}{25}\right)^{9-x}$

ANSWER:

-9

18	Solve problems involving exponential growth and decay	Example -5-مثال+(5)	163
	حل مسائل تتضمن نموًا وتضاءلًا أسيين	(21-26)(Continuously parts-أجزاء المستمرة)	166
	Apply the One -to -One Property of Exponential Functions to solve equations	Example-1 -مثال+(1A,1B)	190
	تطبيق خاصية واحد لواحد للدوال الأسية لحل المعادلات	(1-10)	196

9. **INTERNET** The number of people P in millions using two different search engines to surf the Internet t weeks after the creation of the search engine can be modeled by $P_1(t) = 1.5^{t+4}$ and $P_2(t) = 2.25^{t-3.5}$, respectively. During which week did the same number of people use each search engine?

ANSWER:

11

10. **FINANCIAL LITERACY** Brandy is planning on investing \$5000 and is considering two savings accounts. The first account is continuously compounded and offers a 3% interest rate. The second account is annually compounded and also offers a 3% interest rate, but the bank will match 4% of the initial investment.

a. Write an equation for the balance of each savings account at time t years.

b. How many years will it take for the continuously compounded account to catch up with the annually compounded savings account?

c. If Brandy plans on leaving the money in the account for 30 years, which account should she choose?

ANSWER:

a. $A = 5000e^{0.03t}$; $A = 5200(1.03)^t$

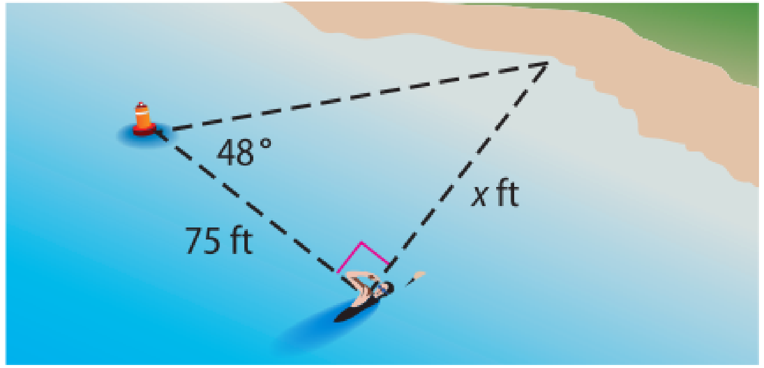
b. about 89 yr

c. The annually compounded account would be the better choice.

19	Solve right triangles حل المثلثات القائمة الزاوية	Example -4-مثال+(4)	225
		(27-30)	229

GuidedPractice

4. **TRIATHLONS** Suppose a competitor in the swimming portion of the race is swimming along the course shown. Find the distance the competitor must swim to reach the shore.



27. **MOUNTAIN CLIMBING** A team of climbers must determine the width of a ravine in order to set up equipment to cross it. If the climbers walk 25 feet along the ravine from their crossing point, and sight the crossing point on the far side of the ravine to be at a 35° angle, how wide is the ravine?

ANSWER:

17.5 ft

28. **SNOWBOARDING** Brad built a snowboarding ramp with a height of 3.5 feet and an 18° incline.

a. Draw a diagram to represent the situation.

b. Determine the length of the ramp.

ANSWER:

a.

b. 11.3 ft

29. **DETOUR** Traffic is detoured from Elwood Ave., left 0.8 mile on Maple St., and then right on Oak St., which intersects Elwood Ave. at a 32° angle.

a. Draw a diagram to represent the situation.

b. Determine the length of Elwood Ave. that is detoured.

ANSWER:

a.

b. 1.3 mi

30. **PARACHUTING** A paratrooper encounters stronger winds than anticipated while parachuting from 1350 feet, causing him to drift at an 8° angle. How far from the drop zone will the paratrooper land?

ANSWER:

190 ft

1. $(\sec^2\theta - 1)\cos^2\theta = \sin^2\theta$

SOLUTION:

$(\sec^2\theta - 1)\cos^2\theta$

$= (\tan^2\theta)\cos^2\theta$ Pythagorean Identity

$= \left(\dfrac{\sin^2\theta}{\cos^2\theta}\right)\cos^2\theta$ Quotient Identity

$= \sin^2\theta$ Multiply and divide out common factor.

2. $\sec^2\theta(1 - \cos^2\theta) = \tan^2\theta$

SOLUTION:

$\sec^2\theta(1 - \cos^2\theta)$

$= \sec^2\theta - \sec^2\theta\cos^2\theta$ Distributive Property

$= \sec^2\theta - \dfrac{1}{\cos^2\theta}\cdot\cos^2\theta$ Reciprocal Identity

$= \sec^2\theta - 1$ Multiply and divide out common factor.

$= \tan^2\theta$ Pythagorean Identity

3. $\sin\theta - \sin\theta\cos^2\theta = \sin^3\theta$

SOLUTION:

$\sin\theta - \sin\theta\cos^2\theta$

$= \sin\theta(1-\cos^2\theta)$ Factor.

$= \sin\theta\sin^2\theta$ Pythagorean Identity

$= \sin^3\theta$ Multiply.

4. $\csc\theta - \cos\theta\cot\theta = \sin\theta$

SOLUTION:

$\csc\theta - \cos\theta\cot\theta$

$= \dfrac{1}{\sin\theta} - \cos\theta\left(\dfrac{\cos\theta}{\sin\theta}\right)$ Reciprocal/Quotient Identities

$= \dfrac{1-\cos^2\theta}{\sin\theta}$ Write with a com denom

$= \dfrac{\sin^2\theta}{\sin\theta}$ Pythagorean Identity

$= \sin\theta$ Divide out factor of $\sin\theta$

5. $\cot^2\theta\csc^2\theta - \cot^2\theta = \cot^4\theta$

SOLUTION:

$\cot^2\theta\csc^2\theta - \cot^2\theta$

$= \cot^2\theta(\csc^2\theta - 1)$ Factor.

$= \cot^2\theta\cot^2\theta$ Pythagorean Identity

$= \cot^4\theta$ Multiply and add exponents.

6. $\tan\theta\csc^2\theta - \tan\theta = \cot\theta$

SOLUTION:

$\tan\theta\csc^2\theta - \tan\theta$

$= \tan\theta(\csc^2\theta - 1)$ Factor

$= \tan\theta\cot^2\theta$ Pythagorean Identity

$= \dfrac{\sin\theta}{\cos\theta}\cdot\dfrac{\cos^2\theta}{\sin^2\theta}$ Quotient Identities

$= \dfrac{\cos\theta}{\sin\theta}$ Multiply and divide common factors.

$= \cot\theta$ Quotient Identity

7. $\dfrac{\sec\theta}{\sin\theta} - \dfrac{\sin\theta}{\cos\theta} = \cot\theta$

SOLUTION:

$$\frac{\sec\theta}{\sin\theta} - \frac{\sin\theta}{\cos\theta}$$

$$= \frac{\frac{1}{\cos\theta}}{\sin\theta} - \frac{\sin\theta}{\cos\theta} \quad \text{Reciprocal Identity}$$

$$= \frac{1}{\sin\theta\cos\theta} - \frac{\sin^2\theta}{\sin\theta\cos\theta} \quad \text{Common denominator}$$

$$= \frac{1-\sin^2\theta}{\sin\theta\cos\theta} \quad \text{Write with a com denom}$$

$$= \frac{\cos^2\theta}{\sin\theta\cos\theta} \quad \text{Pythagoren Identity}$$

$$= \frac{\cos\theta}{\sin\theta} \quad \text{Divide out } \cos\theta.$$

$$= \cot\theta \quad \text{Quotient Identity}$$

8. $\dfrac{\sin\theta}{1-\cos\theta} + \dfrac{1-\cos\theta}{\sin\theta} = 2\csc\theta$

SOLUTION:

$$\frac{\sin\theta}{1-\cos\theta} + \frac{1-\cos\theta}{\sin\theta}$$

$$= \frac{\sin\theta}{\sin\theta}\cdot\frac{\sin\theta}{1-\cos\theta} + \frac{1-\cos\theta}{1-\cos\theta}\cdot\frac{1-\cos\theta}{\sin\theta} \quad \text{Rewrite using com denom}$$

$$= \frac{\sin^2\theta}{\sin\theta(1-\cos\theta)} + \frac{1-2\cos\theta+\cos^2\theta}{\sin\theta(1-\cos\theta)} \quad \text{Mulitply}$$

$$= \frac{\sin^2\theta+\cos^2\theta+1-2\cos\theta}{\sin\theta(1-\cos\theta)} \quad \text{Write with a com denom}$$

$$= \frac{1+1-2\cos\theta}{\sin\theta(1-\cos\theta)} \quad \text{Pythagorean Identity}$$

$$= \frac{2-2\cos\theta}{\sin\theta(1-\cos\theta)} \quad \text{Add}$$

$$= \frac{2(1-\cos\theta)}{\sin\theta(1-\cos\theta)} \quad \text{Factor}$$

$$= \frac{2}{\sin\theta} \quad \text{Divide out } (1-\cos\theta)$$

$$= 2\csc\theta \quad \text{Reciprocal Identity}$$

9. $\dfrac{\cos\theta}{1+\sin\theta}+\tan\theta=\sec\theta$

SOLUTION:

$$\frac{\cos\theta}{1+\sin\theta}+\tan\theta$$

$$=\frac{\cos\theta}{1+\sin\theta}+\frac{\sin\theta}{\cos\theta}$$ Quotient Identity

$$=\frac{\cos\theta}{\cos\theta}\cdot\frac{\cos\theta}{1+\sin\theta}+\frac{1+\sin\theta}{1+\sin\theta}\cdot\frac{\sin\theta}{\cos\theta}$$ Rewrite 1 with com denom

$$=\frac{\cos^2\theta}{\cos\theta(1+\sin\theta)}+\frac{\sin\theta+\sin^2\theta}{(1+\sin\theta)\cos\theta}$$ Multiply

$$=\frac{\cos^2\theta+\sin\theta+\sin^2\theta}{\cos\theta(1+\sin\theta)}$$ Write as a single fraction

$$=\frac{1+\sin\theta}{\cos\theta(1+\sin\theta)}$$ Pythagorean Identity

$$=\frac{1}{\cos\theta}$$ Divide out $(1+\sin\theta)$

$$=\sec\theta$$ Reciprocal Identity

10. $\dfrac{\sin\theta}{1-\cot\theta}+\dfrac{\cos\theta}{1-\tan\theta}=\sin\theta+\cos\theta$

SOLUTION:

$$\frac{\sin\theta}{1-\cot\theta}+\frac{\cos\theta}{1-\tan\theta}$$

$$=\frac{\sin\theta}{1-\frac{\cos\theta}{\sin\theta}}+\frac{\cos\theta}{1-\frac{\sin\theta}{\cos\theta}}$$ Quotient Identity

$$=\frac{\sin\theta}{\frac{\sin\theta}{\sin\theta}-\frac{\cos\theta}{\sin\theta}}+\frac{\cos\theta}{\frac{\cos\theta}{\cos\theta}-\frac{\sin\theta}{\cos\theta}}$$ Rewrite using com denom

$$=\frac{\sin\theta}{\frac{\sin\theta-\cos\theta}{\sin\theta}}+\frac{\cos\theta}{\frac{\cos\theta-\sin\theta}{\cos\theta}}$$ Write denom as single fractions

$$=\frac{\sin^2\theta}{\sin\theta-\cos\theta}+\frac{\cos^2\theta}{\cos\theta-\sin\theta}$$ Simplify fractions

$$=\frac{\sin^2\theta}{\sin\theta-\cos\theta}-\frac{\cos^2\theta}{\sin\theta-\cos\theta}$$ Factor out -1

$$=\frac{\sin^2\theta-\cos^2\theta}{\sin\theta-\cos\theta}$$ Write as a single fraction

$$=\frac{(\sin\theta+\cos\theta)(\sin\theta-\cos\theta)}{\sin\theta-\cos\theta}$$ Factor numerator

$$=\sin\theta+\cos\theta$$ Divide out $(\sin\theta-\cos\theta)$

11. $\dfrac{1}{1-\tan^2\theta}+\dfrac{1}{1-\cot^2\theta}=1$

SOLUTION:

$$\frac{1}{1-\tan^2\theta}+\frac{1}{1-\cot^2\theta}$$

$$=\frac{1}{1-\frac{\sin^2\theta}{\cos^2\theta}}+\frac{1}{1-\frac{\cos^2\theta}{\sin^2\theta}}$$ Quotient Identity

$$=\frac{1}{\frac{\cos^2\theta}{\cos^2\theta}-\frac{\sin^2\theta}{\cos^2\theta}}+\frac{1}{\frac{\sin^2\theta}{\sin^2\theta}-\frac{\cos^2\theta}{\sin^2\theta}}$$ Rewrite 1 using com denom

$$=\frac{1}{\frac{\cos^2\theta-\sin^2\theta}{\cos^2\theta}}+\frac{1}{\frac{\sin^2\theta-\cos^2\theta}{\sin^2\theta}}$$ Write denom as single fractions

$$=\frac{\cos^2\theta}{\cos^2\theta-\sin^2\theta}+\frac{\sin^2\theta}{\sin^2\theta-\cos^2\theta}$$ Simplify fractions

$$=\frac{\cos^2\theta}{\cos^2\theta-\sin^2\theta}+\frac{-\sin^2\theta}{\cos^2\theta-\sin^2\theta}$$ Common denominator

$$=\frac{\cos^2\theta-\sin^2\theta}{\cos^2\theta-\sin^2\theta}$$ Write as a single fraction

$$=1$$ Divide out $\left(\cos^2\theta-\sin^2\theta\right)$

12. $\dfrac{1}{\csc\theta+1}+\dfrac{1}{\csc\theta-1}=2\sec^2\theta\sin\theta$

SOLUTION:

$$\frac{1}{\csc\theta+1}+\frac{1}{\csc\theta-1}$$

$$=\frac{\csc\theta-1}{\csc\theta-1}\cdot\frac{1}{\csc\theta+1}+\frac{\csc\theta+1}{\csc\theta+1}\cdot\frac{1}{\csc\theta-1}$$ Common denominator

$$=\frac{\csc\theta-1}{\csc^2\theta-1}+\frac{\csc\theta+1}{\csc^2\theta-1}$$ Multiply

$$=\frac{2\csc\theta}{\csc^2\theta-1}$$ Write as a single fraction

$$=\frac{2\csc\theta}{\cot^2\theta}$$ Pythagorean Identity

$$=\frac{2\left(\frac{1}{\sin\theta}\right)}{\frac{\cos^2\theta}{\sin^2\theta}}$$ Reciprocal/Quotient Identities

$$=\frac{2}{\sin\theta}\cdot\frac{\sin^2\theta}{\cos^2\theta}$$ Rewrite using multiplication

$$=\frac{2\sin\theta}{\cos^2\theta}$$ Multiply

$$=\left(\frac{2}{\cos^2\theta}\right)\sin\theta$$ Factor

$$=2\sec^2\theta\sin\theta$$ Reciprocal Identity

13. $(\csc\theta - \cot\theta)(\csc\theta + \cot\theta) = 1$

SOLUTION:

$(\csc\theta - \cot\theta)(\csc\theta + \cot\theta)$

$= \csc^2\theta - \cot^2\theta$ Multiply.

$= 1$ Pythagorean Identity

14. $\cos^4\theta - \sin^4\theta = \cos^2\theta - \sin^2\theta$

SOLUTION:

$\cos^4\theta - \sin^4\theta$

$= (\cos^2\theta + \sin^2\theta)(\cos^2\theta - \sin^2\theta)$ Factor

$= 1(\cos^2\theta - \sin^2\theta)$ Pythagorean Identity

$= \cos^2\theta - \sin^2\theta$ Multiply

15. $\dfrac{1}{1-\sin\theta}+\dfrac{1}{1+\sin\theta}=2\sec^2\theta$

SOLUTION:

$$\frac{1}{1-\sin\theta}+\frac{1}{1+\sin\theta}$$

$$=\frac{1+\sin\theta}{1+\sin\theta}\cdot\frac{1}{1-\sin\theta}+\frac{1-\sin\theta}{1-\sin\theta}\cdot\frac{1}{1+\sin\theta}$$ Common denominator

$$=\frac{1+\sin\theta}{1-\sin^2\theta}+\frac{1-\sin\theta}{1-\sin^2\theta}$$ Multiply

$$=\frac{2}{1-\sin^2\theta}$$ Write as a single fraction

$$=\frac{2}{\cos^2\theta}$$ Pythagorean Identity

$$=2\sec^2\theta$$ Reciprocal Identity

16. $\dfrac{\cos\theta}{1+\sin\theta}+\dfrac{\cos\theta}{1-\sin\theta}=2\sec\theta$

SOLUTION:

$$\frac{\cos\theta}{1+\sin\theta}+\frac{\cos\theta}{1-\sin\theta}$$

$$=\frac{\cos\theta}{1+\sin\theta}\cdot\frac{1-\sin\theta}{1-\sin\theta}+\frac{\cos\theta}{1-\sin\theta}\cdot\frac{1+\sin\theta}{1+\sin\theta}$$ Common denominator

$$=\frac{\cos\theta(1-\sin\theta)}{(1+\sin\theta)(1-\sin\theta)}+\frac{\cos\theta(1+\sin\theta)}{(1-\sin\theta)(1+\sin\theta)}$$ Multiply

$$=\frac{\cos\theta(1-\sin\theta)+\cos\theta(1+\sin\theta)}{(1+\sin\theta)(1-\sin\theta)}$$ Write as a single fraction

$$=\frac{\cos\theta-\sin\theta\cos\theta+\cos\theta+\sin\theta\cos\theta}{1-\sin^2\theta}$$ Multiply

$$=\frac{2\cos\theta}{1-\sin^2\theta}$$ Simplify the numerator

$$=\frac{2\cos\theta}{\cos^2\theta}$$ Pythagorean Identity

$$=\frac{2}{\cos\theta}$$ Divide out $\cos\theta$

$$=2\sec\theta$$ Quotient Identity

17. $\csc^4\theta - \cot^4\theta = 2\cot^2\theta + 1$

SOLUTION:

$\csc^4\theta - \cot^4\theta$

$= (\csc^2\theta - \cot^2\theta)(\csc^2\theta + \cot^2\theta)$	Factor
$= [\csc^2\theta - (\csc^2\theta - 1)][\csc^2\theta + (\csc^2\theta - 1)]$	Pythagorean Identity
$=[\csc^2\theta - \csc^2\theta + 1)][\csc^2\theta + \csc^2\theta - 1]$	Multiply
$=[1][2\csc^2\theta - 1]$	Add
$= 2\csc^2\theta - 1$	Multiply
$= 2(\cot^2\theta + 1) - 1$	Pythagorean Identity
$= 2\cot^2\theta + 2 - 1$	Multiply
$= 2\cot^2\theta + 1$	Add

18. $\dfrac{\csc^2\theta + 2\csc\theta - 3}{\csc^2\theta - 1} = \dfrac{\csc\theta + 3}{\csc\theta + 1}$

SOLUTION:

$$\frac{\csc^2\theta + 2\csc\theta - 3}{\csc^2\theta - 1}$$

$= \dfrac{(\csc\theta + 3)(\csc\theta - 1)}{(\csc\theta + 1)(\csc\theta - 1)}$	Factor
$= \dfrac{\csc\theta + 3}{\csc\theta + 1}$	Divide out $(\csc\theta - 1)$