CLEP
Pre-Calculus

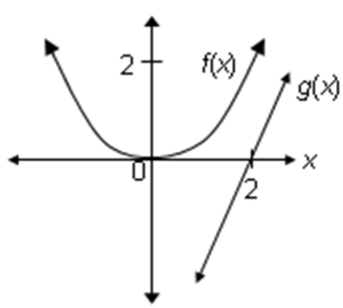
Section 1: Time—30 Minutes 50 Questions	For each question below, choose the best answer from the choices given. An online graphing calculator (non-CAS) is allowed to be used for this section.

1. According to the tables for $f(x)$ and $g(x)$ below, what is the value of $[f + g](-1)$?

x	$f(x)$	x	$g(x)$
–2	4	–3	2
–1	3	–1	4
0	1	0	5
1	5	1	7
2	7	3	10

(A) 3
(B) 4
(C) 7
(D) 10
(E) 12

2. According to the graphs of $f(x)$ and $g(x)$ shown, what is the value of $[g - f](2)$?



(A) –2
(B) 0
(C) 1
(D) 2
(E) Cannot be determined

3. Alex's grades are shown in the table below for pre-calculus tests. If each test is weighted equally, what is the lowest grade that Alex can score on the fifth and final test to have an average of at least 90%?

Test	Grade
#1	85%
#2	93%
#3	86%
#4	94%

(A) 89.5%
(B) 90%
(C) 90.5%
(D) 92%
(E) 94%

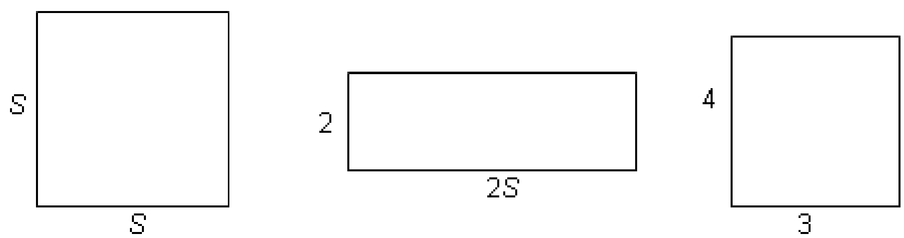
4. Which of the following could be an equation for the hyperbola shown?

(A) $\dfrac{(y-5)^2}{a^2}-\dfrac{(x+4)^2}{b^2}=1$
(B) $\dfrac{(x+4)^2}{a^2}-\dfrac{(y-5)^2}{b^2}=1$
(C) $\dfrac{(y+5)^2}{a^2}-\dfrac{(x-4)^2}{b^2}=1$
(D) $\dfrac{y^2}{25}-\dfrac{x^2}{16}=1$
(E) $\dfrac{(y+5)^2}{a^2}+\dfrac{(x+4)^2}{b^2}=1$

5. Let $f(x) = 2x - 6$, and let $g(x) = 5x + 4$. Which of the following is equivalent to $[f \times g](x)$?

(A) $10x^2 - 38x - 24$
(B) $10x + 2$
(C) $-3x - 2$
(D) $10x^2 - 24$
(E) $10x^2 - 22x - 24$

6. Find S so that the sum of the areas of the three figures shown is less than 24.



(A) $-2 < S < 6$
(B) $S < 2$ or $S < -6$
(C) $-6 < S < 2$
(D) $S < 12$
(E) Cannot be determined

7. Suppose $\cos(\theta) = \frac{1}{8}$. What is the value of $\tan(\theta)$?

(A) $7\sqrt{3}$
(B) $\sqrt{65}$
(C) $3\sqrt{7}$
(D) $\sqrt{7}$
(E) 8

8. Find the exact value for x if $4^{2x} - 16 = 4$.

(A) $\dfrac{2\log(20)}{\log(4)}$

(B) $\dfrac{\log(20)}{\log(4)}$

(C) $\dfrac{\log(20)}{2\log(4)}$

(D) $\dfrac{\log(4)}{2\log(20)}$

(E) $\dfrac{2\log(4)}{\log(20)}$

9. What is the circumference of the circle with equation $(x-3)^2 + (y+1)^2 = 49$?

(A) 7π
(B) 14π
(C) 28π
(D) 49π
(E) $\sqrt{60}\pi$

10. An ellipse has an equation of $\frac{(x-3)^2}{4} + \frac{(y+1)^2}{9} = 1$. Which statement is true about this ellipse?

(A) The center is at (3, –1) with a horizontal major axis.
(B) The center is at (3, –1) with a vertical major axis.
(C) The center is at (-3, 1) with a horizontal major axis.
(D) The center is at (-3, 1) with a vertical major axis.
(E) The center is at (-3, -1) with a vertical major axis.

11. Find the range of the function $h(x) = \frac{1}{\sqrt{2-x}} + 5$.

(A) $(-\infty, 2)$
(B) $(5, \infty)$
(C) $(-\infty, \infty)$
(D) $(-\infty, 5)$
(E) $(2, \infty)$

12. Find three functions, $f(x)$, $g(x)$, and $h(x)$, such that $[f \circ g \circ h](x) = F(x)$ if $F(x) = \frac{1}{\cos(x)+5}$.

(A) $f(x) = \frac{1}{x}, g(x) = x+5, h(x) = \cos(x)$
(B) $f(x) = \cos(x), g(x) = \frac{1}{5}x, h(x) = x+5$
(C) $f(x) = \cos(x), g(x) = x + \frac{1}{5}, h(x) = x$
(D) $f(x) = \frac{1}{x}, g(x) = x-5, h(x) = \sin(x)$
(E) $f(x) = \frac{1}{x}, g(x) = x-5, h(x) = \cos(x)$

13. If $5x + 4y = 16$ and $6x - 3y = 9$, what is the value of $2x + 1$?

14. For each of the functions, indicate if the function is even, odd, or neither.

Function	Even	Odd	Neither
$f(x) = 4x^2$			
$g(x) = 5\sin(\theta)$			
$h(x) = x^3 - x + 5$			

15. If $\frac{1}{2}x^{\frac{2}{3}} - 6 = 2$, what is the value of x?

(A) $4\sqrt[3]{4}$
(B) 8
(C) 16
(D) 24
(E) 64

16. Which of the following equations has a y-intercept of 1?

(A) $y = x - 1$
(B) $y = 2x + 1$
(C) $y = x^2 + 3x - 1$
(D) $y = 2^{x+3} - 7$
(E) $y = \sin(x)$

17. Let $f(x) = x^2 - 3$, and let the values of $g(x)$ be as shown in the table:

x	$g(x)$
–1	–4
0	–1
1	2
2	4
3	3
4	1

What is the value of $f(g(2))$?

(A) 1
(B) 2
(C) 4
(D) 13
(E) 15

18. If $\cot(\theta) = \frac{p}{6}$, what is the value of $\csc(\theta)$?

(A) $\frac{\sqrt{36+p^2}}{6}$

(B) $\frac{\sqrt{(p+6)(p-6)}}{6}$

(C) $\frac{p-6}{6}$

(D) $\frac{6+p}{6}$

(E) $\frac{6}{p}$

19. Find y if $5y \tan(30°) = 10$.

(A) $\frac{2\sqrt{3}}{3}$

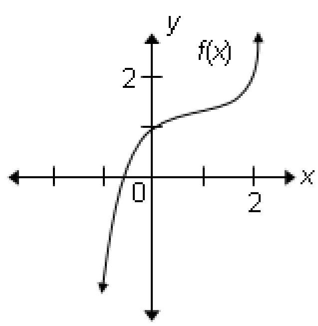
(B) 2

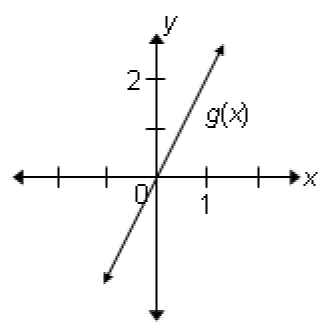
(C) $2\sqrt{3}$

(D) 4

(E) $\frac{1}{\sqrt{3}}$

20. The graphs of $f(x)$ and $g(x)$ are shown here. What is the value of $g(f(0))$?





(A) 0
(B) 1
(C) 2
(D) 3
(E) Cannot be determined

21. Which of the following could be an equation for the parabola with its vertex at the point (–6, 8) and a vertical axis?

(A) $(x+6)^2 = c(y-8)$
(B) $(x-6)^2 = c(y+8)$
(C) $(y+6)^2 = c(x-8)$
(D) $(y-6)^2 = x(c+8)$
(E) $(y-6)^2 = x(c-8)$

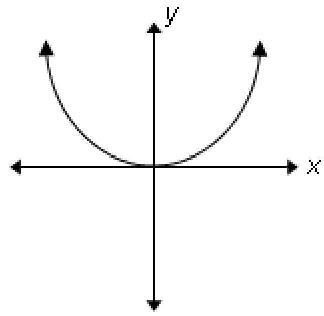
22. Let $g(x) = x^2 + 3x - 6$, and let $h(x) = 2x^2 + 5x - 8$. What is $g(h(x))$?

(A) $2x^4 + 12x^3 - x^2 - 57x + 34$
(B) $4x^4 + 20x^3 - x^2 - 65\text{x} + 34$
(C) $3x^2 + 8x - 14$
(D) $2x^4 + 11x^3 - 5x^2 - 54x + 48$
(E) $4x^4 + 20x^3 - 22x^2 - 65\text{x} + 34$

23. If $\cos(\theta) = \frac{z}{2}$, what is the value of $\sin(\theta)$?

(A) $\frac{2-z}{2}$
(B) $\frac{\sqrt{4+z^2}}{2}$
(C) $\frac{2+z}{2}$
(D) $\frac{\sqrt{4-z}}{2}$
(E) $\frac{\sqrt{(2-z)(2+z)}}{2}$

24. Which of the following is true about the inverse of the function shown in the graph below?



(A) The domain of the function is all real numbers.
(B) The range of the function is all positive real numbers.
(C) The inverse is not a function.
(D) The inverse is one-to-one.
(E) Both B and D

25. What is the value of sin(150°)?

(A) $\frac{3}{2}$

(B) $\frac{\sqrt{3}}{2}$

(C) $\frac{\sqrt{3}+\sqrt{2}}{2}$

(D) $-\frac{1}{2}$

(E) $\frac{1}{2}$

Section 2: Time—30 Minutes 50 Questions	For each question below, choose the best answer from the choices given. No calculator is allowed for this section.

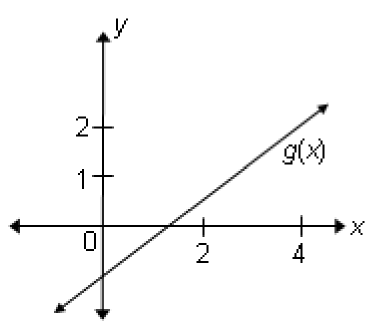
26. Which of the following is NOT true about the function represented in the table?

x	$f(x)$
0	–6
1	–3
2	0
3	3
4	6
5	9

(A) The function is increasing as x moves from 0 to 5.
(B) The graph intersects the x-axis at –6.
(C) The slope as x moves from 0 to 5 is 3.
(D) Both B and C.
(E) All of the above

27. Let $h(x)$ be the function represented in the table, and let $g(x)$ be the function shown in the graph. What is the value of $g(h(3))$?

x	$h(x)$
–3	–10
–1	–6
0	–2
1	0
3	4
5	7



(A) 0
(B) 2
(C) 4
(D) 5
(E) 7

28. Jeffrey's job pays him \$20 per hour and 15% commission on all of his sales. Last week, Jeffrey worked 40 hours and made x *dollars* in sales. Which of the following expresses the total amount of money that Jeffrey made last week as a function of x?

(A) $M = 800 + 0.15x$
(B) $M = 40x + 300$
(C) $M = 20x + 600$
(D) $M = 800 + 15x$
(E) $M = 20 + .15x$

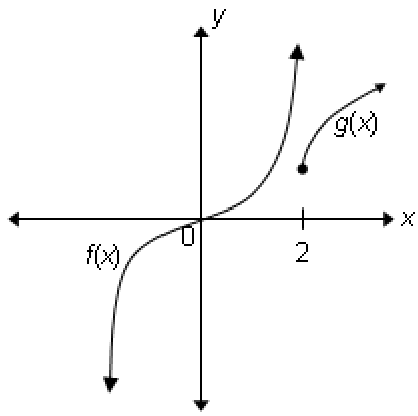
29. Two buildings facing each other are separated by a distance of 40 feet. From the top of the first building, the angle of depression of the second building's base is 60°, and the angle of depression of the top of the second building is 45°. What is the height of the second building?

(A) $40(\sqrt{3}-1)$
(B) $\dfrac{40}{\sqrt{3}-1}$
(C) $\dfrac{\sqrt{3}-1}{40}$
(D) $40(1-\sqrt{3})$
(E) Not enough information to solve this problem

30. Let $f(x) = x^2 - 9x + 7$, and let $g(x) = 3x^2 - 4x - 10$. What is the value of $f(g(2))$?

31. Michelle is flying a kite that is 18 feet high. If the string of the kite forms a 60° angle with the ground, and Michelle is holding the kite 3 feet off the ground, what is the length of the string? Write your answer to the nearest hundredth of a foot.

32. According to the graphs of $f(x)$ and $g(x)$ below, what is the domain of $[f+g](x)$?



(A) $(-\infty, \infty)$
(B) $[-2, \infty)$
(C) $(2, \infty)$
(D) $(-\infty, 2)$
(E) $[2, \infty)$

33. The length of a rectangle is 4 more than 2 times the width. Which of the following is an equation for the length of the diagonal of the rectangle in terms of the width?

(A) $d = 4 + 2w$
(B) $d = \sqrt{4w^2 + 16w + 16}$
(C) $d = 5w^2 + 16w + 16$
(D) $d = \sqrt{5w^2 + 16w + 16}$
(E) $d = 4w^2 + 16w + 18$

34. Let $f(x) = 3x^2 - 4x - 5$, and let What is the value of $[f - g](5)$?

(A) –5.68
(B) 0.049
(C) 49.8
(D) 50
(E) 50.2

35. What is the range of the function $y = \cos(x)$?

(A) $[-1, 1]$
(B) all real numbers
(C) all rational numbers
(D) $[0, 1]$
(E) $[-1, 0]$

36. Suppose $2\sin(\theta)\cos(\theta) = \frac{3}{4}$. What is the approximate value of θ?

(A) 21°
(B) 24°
(C) 41°
(D) 49°
(E) 51°

37. Suppose the volume of a cylinder is 30 cubic inches. Which of the following is an expression of the surface area of the cylinder in terms of its radius?

(A) $S = \frac{60}{r}$

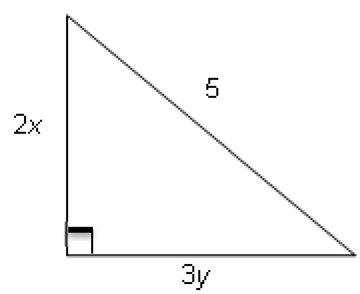
(B) $S = 2\pi(r)^2 + \frac{60}{r}$

(C) $S = \frac{30}{\pi(r)^2}$

(D) $S = 2\pi(r)^2 + \frac{30}{\pi(r)^2}$

(E) $S = 2\pi(r)^2$

38. The sum of all three sides of the right triangle shown is 12. Find the lengths of its two legs.



39. According to the tables of values for $f(x)$ and $g(x)$, what is the value of $\left[\frac{f}{g}\right](2)$?

x	$f(x)$	$g(x)$
–3	5	–8
–2	3	–5
0	1	1
2	2	3
3	6	7

(A) $\frac{2}{3}$
(B) $\frac{3}{2}$
(C) 3
(D) 6
(E) 7

40. Find all values of q that satisfy the system of equations shown:

$$\begin{cases} 3p^2 + 2pq - 4q^2 = 14 \\ 2p + q = 6 \end{cases}$$

(A) -1.44, 3.56
(B) 2.28, 4.07
(C) 10.56, 14.14
(D) –3.14, –10.28
(E) 1.44, –2.14

41. Let $f(x) = 2x^2 + 6x - 7$, and let $g(x) = 3x^2 - 4x + 12$. What is the value of $\left[\frac{3f}{2g}\right](3)$?

(A) $\frac{58}{81}$
(B) $\frac{29}{27}$
(C) $\frac{29}{18}$
(D) $\frac{17}{9}$
(E) $\frac{3}{2}$

42. Find a range of values for p if $|4-5p| \le 24$.

(A) $p \le -4$
(B) $-4 \le p \le \frac{28}{5}$
(C) $p \le -4$ or $p \ge \frac{28}{5}$
(D) $4 \le p \le \frac{28}{5}$
(E) $p \ge -4$

43. According to the table of values for $f(x)$ and $g(x)$, what is the value of $[f \circ g](2)$?

x	$f(x)$	$g(x)$
–6	8	–10
–4	5	–6
–2	4	–1
0	2	3
2	0	4
4	–2	6

(A) –2
(B) 0
(C) 3
(D) 4
(E) 6

44. A right triangle has legs of length 6 inches and 8 inches. What is the measure of the angle opposite the 6-inch leg?

(A) 48.6°
(B) 41.41°
(C) 53.13°
(D) 36.87°
(E) Not enough information to solve

45. Which of the following values for x and y satisfies the system of equations shown?

$$\begin{cases} 2x + 4y = 20 \\ 3x - 5y = 26 \end{cases}$$

(A) $x = \frac{102}{11}, y = \frac{4}{11}$

(B) $x = -\frac{94}{11}, y = \frac{102}{11}$

(C) $x = \frac{9}{2}, y = \frac{11}{4}$

(D) $x = \frac{118}{11}, y = -\frac{4}{11}$

(E) $x = -2$, $y = 11$

46. A woman is walking along a straight road. She notices the top of a building subtending an angle of 30° with the ground at the point where she is standing. If the building is 50 feet tall, how far is the woman from the building?

(A) 86.6 feet
(B) 28.9 feet
(C) 57.7 feet
(D) 100 feet
(E) 93.2 feet

47. What is the value of sin(75°)?

(A) $\frac{\sqrt{6} + \sqrt{2}}{4}$

(B) $\frac{\sqrt{8}}{4}$

(C) $\frac{1}{2}$

(D) $\frac{\sqrt{6} - \sqrt{2}}{4}$

(E) $-\frac{1}{2}$

48. A number x is first decreased by 25%, and then the result is increased by 10%. Which of the following functions could be used to determine the final result?

(A) $f(x) = 0.15x$
(B) $f(x) = 0.825x$
(C) $f(x) = 0.275x$
(D) $f(x) = 0.35x$
(E) $f(x) = 0.04x$

1. **The correct answer is C.** The algebraic combination, $[f + g](x)$, is defined as $f(x) + g(x)$. According to the table, $f(-1) = 3$ and $g(-1) = 4$. Now find the sum:

$$\begin{aligned}[f+g](-1) &= f(-1) + g(-1) \\ &= 3 + 4 \\ &= 7\end{aligned}$$

2. **The correct answer is A.** The algebraic combination $[g - f](x)$ is defined as $g(x) - f(x)$.

According to the graphs, $g(2) = 0$, and $f(2) = 2$. Now subtract to find the difference:

$$\begin{aligned}[g-f](2) &= g(2) - f(2) \\ &= 0 - 2 \\ &= -2\end{aligned}$$

3. **The correct answer is D.** The average is calculated by dividing the sum of the test scores by the number of tests. Let x equal the score on the fifth and final test:

$$\begin{aligned}\text{Average} &= \frac{\text{sum of scores}}{\text{number of tests}} \\ &= \frac{85+93+86+94+x}{5} \\ &= \frac{358+x}{5}\end{aligned}$$

Now plug in 90 for the average and use an inequality sign to represent the situation in terms of x:

$$\begin{aligned}90 &\le \frac{358+x}{5} \\ 90(5) &\le \left(\frac{358+x}{5}\right)(5) \\ 450 &\le 358 + x \\ 450 - 358 &\le 358 + x - 358 \\ 92 &\le x\end{aligned}$$

4. **The correct answer is A.** The standard form of the equation for a hyperbola centered at the point (h, k) and with a vertical axis is $\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1.$ The hyperbola shown is centered at the point $(-4, 5)$, so an equation for the hyperbola is $\frac{(y-5)^2}{a^2} - \frac{(x+4)^2}{b^2} = 1.$

5. **The correct answer is E.** The algebraic combination $[f \times g](x)$ is defined as $f(x) \times g(x)$. Multiply the equation for $f(x)$ by the equation for $g(x)$ and combine like terms to find the simplified product:

$$\begin{aligned}[f \times g](x) &= f(x) \times g(x) \\ &= (2x-6)\times(5x+4) \\ &= 10x^2 + 8x - 30x - 24 \\ &= 10x^2 - 22x - 24\end{aligned}$$

6. **The correct answer is C.** Write an equation for the sum of the area of the three figures. Then solve the inequality for S:

$$\text{Area} = (S)(S) + (2)(2S) = (3)(4) < 24$$

$$\begin{aligned}S^2 + 4S + 12 &< 24 \\ S^2 + 4S - 12 &< 0 \\ (S-2)(S+6) &< 0\end{aligned}$$

In order for $(S - 2)(S + 6)$ to be less than zero, one of the factors must be negative, and one must be positive:

$$\begin{gathered}(S-2) > 0 \text{ and } (S+6) < 0 \\ S > 2 \text{ and } S < -6 \\ \text{OR} \\ (S-2) < 0 \text{ and } (S+6) > 0 \\ S < 2 \text{ and } S > -6\end{gathered}$$

Since the first solution is impossible, the value of S must lie between –6 and 2.

7. **The correct answer is C.** Since $\sec(\theta) = \dfrac{1}{\cos(\theta)}$, use the identity $\tan^2(\theta) + 1 = \sec^2(\theta)$:

$$\begin{aligned}
\sec(\theta) &= \frac{1}{\cos(\theta)} \\
&= \frac{1}{\frac{1}{8}} \\
&= 8 \\
\tan^2(\theta) + 1 &= \sec^2(\theta) \\
\tan^2(\theta) + 1 &= (8)^2 \\
\tan^2(\theta) + 1 &= 64 \\
\tan^2(\theta) &= 63 \\
\tan(\theta) &= \sqrt{63} \\
&= 3\sqrt{7}
\end{aligned}$$

8. **The correct answer is C.** This equation can be solved using the logarithmic function:

$$\begin{aligned}
4^{2x} - 16 &= 4 \\
4^{2x} &= 20 \\
\log(4^{2x}) &= \log(20) \\
2x\log(4) &= \log(20) \\
x &= \frac{\log(20)}{2\log(4)}
\end{aligned}$$

9. **The correct answer is B.** The standard form for the equation of a circle centered at (h, k) and with radius r is $(x - h)^2 + (y - k)^2 = r^2$. In this case, the radius of the circle is equal to or 7. Use this value for the radius to calculate the circumference:

$$\begin{aligned}
C &= 2\pi(r) \\
&= 2\pi(7) \\
&= 14\pi
\end{aligned}$$

10. **The correct answer is B.** The standard form of the equation for an ellipse centered at the point (h, k) is $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1.$ In this case, the ellipse is centered at the point (3, –1). Since the value for a is less than b, we also know that this equation has a vertical major axis.

11. **The correct answer is B.** First find the domain of the function. In order for $h(x)$ to be a real number, $2 - x \geq 0,$ so $x \leq 2$ and $\sqrt{2-x} \neq 0,$ which means that x cannot be equal to 2. The

domain of $h(x)$ is $(-\infty, 2)$. As x runs through $(-\infty, 2)$, $\frac{1}{\sqrt{2-x}}$ takes on all positive values. The range of $h(x)$ is $(5, \infty)$.

12. **The correct answer is A.** The function $F(x)$ consists of taking the cosine of x, adding 5, and then inverting. Set $h(x) = \cos(x)$, $g(x) = x + 5$, and $f(x) = \frac{1}{x}$. Calculate $[f \circ g \circ h](x)$ to be sure it equals the function $F(x)$:

$$\begin{aligned}[f \circ g \circ h](x) &= f(g(h(x))) \\ &= f(g(\cos(x))) \\ &= f(\cos(x)+5) \\ &= \frac{1}{\cos(x)+5} \\ &= F(x)\end{aligned}$$

13. **The correct answer is 5.3.**

Multiply the first equation through by 3:

$$\begin{gathered}5x+4y=16 \\ 3(5x+4y=16) \\ 15x+12y=48\end{gathered}$$

Multiply the second equation through by 4:

$$\begin{gathered}6x-3y=9 \\ 4(6x-3y=9) \\ 24x+12y=36\end{gathered}$$

Add the equations together and cancel out the y terms, which leaves a linear equation that can be solved for x:

$$\begin{gathered}15x+12y=48 \\ \underline{24x-12y=36} \\ 39x=84 \\ x=\frac{84}{39}=\frac{28}{13}\end{gathered}$$

Calculate $2x + 1$:

$$
\begin{aligned}
2x+1 &= 2\left(\frac{28}{13}\right)+1 \\
&= \frac{56}{13}+\frac{13}{13} \\
&= \frac{69}{13} = 5.3
\end{aligned}
$$

14. **The correct answer is even, odd, and neither.**

Function	**Even**	**Odd**	**Neither**
$f(x) = 4x^2$	x		
$g(x) = 5\sin(\theta)$		x	
$h(x) = x^3 - x + 5$			x

For $f(x) = 4x^2$, you can see on the coordinate plane that this graph is symmetrical about the y-axis, which means that it is an even function.

For $g(x) = 5\sin(\theta)$, we know this is an odd function because the sine curve is symmetrical about the origin.

For $h(x) = x^3 - x + 5$, we know that this is neither odd nor even because the function is shifted and hence will not be symmetrical to the y-axis or the origin.

15. **The correct answer is E.**

$$
\begin{aligned}
\frac{1}{2}x^{\frac{2}{3}} - 6 &= 2 \\
\frac{1}{2}x^{\frac{2}{3}} &= 8 \\
x^{\frac{2}{3}} &= 16 \\
\left(x^{\frac{2}{3}}\right)^{\frac{3}{2}} &= (16)^{\frac{3}{2}} \\
x &= \left(16^{\frac{1}{2}}\right)^3 \\
&= \left(\sqrt{16}\right)^3 \\
&= 4^3 \\
&= 64
\end{aligned}
$$

16. **The correct answer is D.** Plug $x = 0$ into each of the equations to find which one has a y-intercept of 1:

Equation A:	**Equation B:**	**Equation A:**	**Equation D:**	**Equation E:**
$y = x - 1$ $= 0 - 1$ $= -1$	$y = 2x - 1$ $= 2(0) - 1$ $= 0 - 1$ $= -1$	$y = x^2 + 3x - 1$ $= (0)^2 + 3(0) - 1$ $= 0 + 0 - 1$ $= -1$	$y = 2^{x+3} - 7$ $= 2^{(0)+3} - 7$ $= 2^3 - 7$ $= 8 - 7$ $= 1$	$y = \sin(x)$ $= \sin(0)$ $= 0$

The equation given in choice D, $y = 2^{x+3} - 7$ has a y-intercept of 1.

17. **The correct answer is D.** The notation $f(g(2))$ indicates that the value of $g(2)$ must be determined first, and then that value must be plugged into the equation of $f(x)$. Looking at the table, when $x = 2$, $g(x) = 4$, and $g(2) = 4$. Now, plug 4 into the equation $f(x)$:

$$\begin{aligned} f(x) &= x^2 - 3 \\ f(4) &= (4)^2 - 3 \\ &= 16 - 3 \\ &= 13 \end{aligned}$$

So, $f(g(2)) = 13$.

18. **The correct answer is A.** Use the identity $1 + \cot^2(\theta) = \csc^2(\theta)$ to solve for $\csc(\theta)$:

$$\begin{aligned} 1 + \cot^2(\theta) &= \csc^2(\theta) \\ 1 + \left(\frac{p}{6}\right)^2 &= \csc^2(\theta) \\ \frac{36}{36} + \frac{p^2}{36} &= \csc^2(\theta) \\ \frac{\sqrt{36 + p^2}}{6} &= \csc(\theta) \end{aligned}$$

19. **The correct answer is C.** First, calculate the tangent of 30°:

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$
$$\tan 30° = \frac{\sin 30°}{\cos 30°}$$
$$= \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}}$$
$$= \frac{1}{2} \times \frac{2}{\sqrt{3}}$$
$$= \frac{1}{\sqrt{3}}$$

Plug this value into the equation and solve for *y*:

$$5y \tan 30° = 10$$
$$5y(\frac{1}{\sqrt{3}}) = 10$$
$$y = \frac{10\sqrt{3}}{5}$$
$$= 2\sqrt{3}$$

20. **The correct answer is C.** According to the graph of $f(x)$, $f(0) = 1$. Now look at the graph of $g(x)$ to find the value of $g(1)$, which is 2.

21. **The correct answer is A.** The standard form for a parabola with a vertical axis and its vertex at the point (h, k) is $(x - h)^2 = c(y - k)$. An equation for this particular parabola is $(x + 6)^2 = c(y - 8)$.

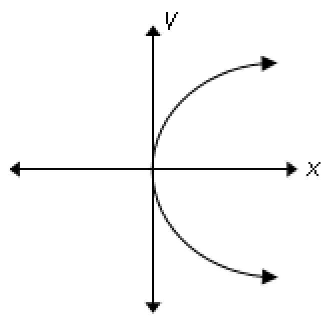
22. **The correct answer is B.** Plug the equation for $h(x)$ into the equation for $g(x)$:

$$g(h(x)) = g(2x^2 + 5x - 8)$$
$$= (2x^2 + 5x - 8)^2 + 3(2x^2 + 5x - 8) - 6$$
$$= (4x^4 + 20x^3 - 7x^2 - 80x + 64) + (6x^2 + 15x - 24) - 6$$
$$= 4x^4 + 20x^3 - x^2 - 65x + 34$$

23. **The correct answer is E.** Use the identity $\sin^2(\theta) + \cos^2(\theta) = 1$:

$$\sin^2(\theta) + \cos^2(\theta) = 1$$
$$\sin^2(\theta) + (\frac{z}{2})^2 = 1$$
$$\sin^2(\theta) + \frac{z^2}{4} = 1$$
$$\sin^2(\theta) = \frac{4 - z^2}{4}$$
$$\sin(\theta) = \frac{\sqrt{(2-z)(2+z)}}{2}$$

24. **The correct answer is C.** The inverse of a function can be found by reflecting the graph across the line $y = x$, as shown below.



Since this graph would not pass the Vertical Line Test, it cannot be a function.

25. **The correct answer is E.** Use the addition formula for the sine function:

$$\sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta)$$
$$\sin(150°) = \sin(60° + 90°)$$
$$= \left(\frac{\sqrt{3}}{2}\right)(0) + \left(\frac{1}{2}\right)(1)$$
$$= 0 + \frac{1}{2}$$
$$= \frac{1}{2}$$

26. **The correct answer is B.** Consider each statement. As x moves from 0 to 5, the values of $f(x)$ steadily increase. The statement in choice A is true. According to the table, when $f(x) = 0$, x is equal to 2. The graph intersects the x-axis at 2. The statement in choice B is not true about the function. Calculate the slope as x goes from 0 to 5:

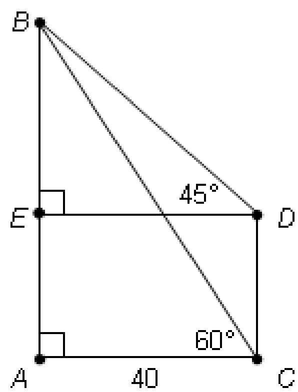
$$\begin{aligned}\text{slope} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{9-(-6)}{5-0} \\ &= \frac{15}{5} \\ &= 3\end{aligned}$$

The slope on this interval is 3, so the statement in choice C is true. The only statement that is not true about the function is the one given in choice B.

27. **The correct answer is B.** Use the table to find the value of $h(3)$, which is 4. Then use the graph to find the value of $g(4)$, which is 2. The value of $g(h(3))$ is 2.

28. **The correct answer is A.** Since Jeffrey worked for 40 hours at $20 per hour, he earned $800. He also made 15% of x dollars, which is equal to $0.15x$. In total, Jeffrey earned $\$800 + 0.15x$ last week.

29. **The correct answer is A.** Draw a diagram to represent the situation:



Use the trigonometric identity $\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$:

$$\begin{aligned}\tan(45°) &= \frac{BE}{40} \\ 1 &= \frac{BE}{40} \\ BE &= 40\end{aligned}$$

Also,

$$\tan(60°) = \frac{AB}{40}$$
$$\sqrt{3} = \frac{AB}{40}$$
$$AB = 40\sqrt{3}$$

Notice that $CD = AB - BE$:

$$\begin{aligned} CD &= 40\sqrt{3} - 40 \\ &= 40(\sqrt{3} - 1) \end{aligned}$$

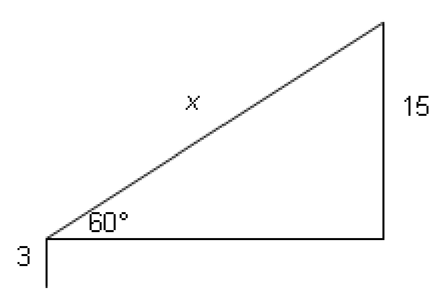
30. **The correct answer is 97.** First determine the value of $g(2)$ by plugging 2 into the equation of $g(x)$:

$$\begin{aligned} g(x) &= 3x^2 - 4x - 10 \\ g(2) &= 3(2)^2 - 4(2) - 10 \\ &= 3(4) - 8 - 10 \\ &= 12 - 8 - 10 \\ &= -6 \end{aligned}$$

Now plug –6 into the equation of $f(x)$ for x:

$$\begin{aligned} f(x) &= x^2 - 9x + 7 \\ f(-6) &= (-6)^2 - 9(-6) + 7 \\ &= 36 + 54 + 7 \\ &= 97 \end{aligned}$$

31. **The correct answer is 17.32 feet.** Draw a diagram illustrating the situation:



Use the trigonometric identity $\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}}$:

$$\sin(60°) = \frac{15}{x}$$
$$\frac{\sqrt{3}}{2} = \frac{15}{x}$$
$$x\sqrt{3} = 30$$
$$x = \frac{30}{\sqrt{3}} = 17.32$$

32. **The correct answer is E.** The domain of the algebraic combination $[f + g](x)$ is defined as $dom(f) \cap dom(g)$. According to the graph, the domain of $f(x)$ is all real numbers, or $(-\infty, \infty)$, and the domain of $g(x)$ is all real numbers greater than or equal to 2, or $[2, \infty)$. The intersection of the domain of $f(x)$ and the domain of $g(x)$ is $[2, \infty)$.

33. **The correct answer is D.** Let l equal the length of the rectangle, let w equal the width of the rectangle, and let d equal the length of the diagonal of the rectangle. The length is 4 more than 2 times the width, so $l = 4 + 2w$. Now use the Pythagorean Theorem to find the length of the diagonal:

$$a^2 + b^2 = c^2$$
$$(4 + 2w)^2 + w^2 = d^2$$
$$16 + 16w + 4w^2 + w^2 = d^2$$
$$5w^2 + 16w + 16 = d^2$$
$$\sqrt{5w^2 + 16w + 16} = d$$

34. **The correct answer is C.** The algebraic combination $[f - g](x)$ is defined as $f(x) - g(x)$. Plug x – 5 into the equation of $f(x)$ to find $f(5)$:

$$\begin{aligned} f(x) &= 3x^2 - 4x - 5 \\ f(5) &= 3(5)^2 - 4(5) - 5 \\ &= 3(25) - 20 - 5 \\ &= 75 - 20 - 5 \\ &= 50 \end{aligned}$$

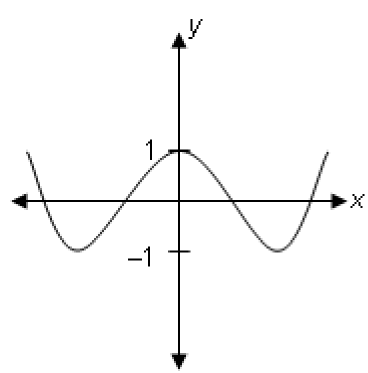
Now plug $x = 5$ into the equation for $g(x)$ to find $g(5)$:

$$
\begin{aligned}
g(x) &= \frac{\sqrt{4+x}}{3x} \\
g(5) &= \frac{\sqrt{4+(5)}}{3(5)} \\
&= \frac{\sqrt{9}}{15} \\
&= \frac{3}{15} \\
&= \frac{1}{5}
\end{aligned}
$$

Now subtract to find the difference:

$$
\begin{aligned}
[f-g](5) &= f(5) - g(5) \\
&= 50 - \frac{1}{5} \\
&= \frac{250}{5} - \frac{1}{5} \\
&= \frac{249}{5} \\
&\approx 49.8
\end{aligned}
$$

35. **The correct answer is A.** Graph the function to observe which y values have corresponding x values:



The y values range from –1 to 1. The range of the function is [–1, 1].

36. **The correct answer is A.** Use the double angle formula cos(2θ) =2sin(θ)cos(θ):

$$\cos(2\theta) = 2\sin(\theta)\cos(\theta)$$
$$\cos(2\theta) = \frac{3}{4}$$
$$\cos^{-1}(\cos(2\theta)) = \cos^{-1}(\frac{3}{4})$$
$$2\theta = 41.4°$$
$$\theta \approx 21°$$

37. **The correct answer is B.** Use the formula for the volume to solve for *h*, the height, in terms of *r*:

$$V = \pi(r)^2 h$$
$$30 = \pi(r)^2 h$$
$$h = \frac{30}{\pi(r)^2}$$

Plug this value into the formula for the surface area:

$$\begin{aligned} S &= 2\pi(r)^2 + 2\pi(r)(h) \\ &= 2\pi(r)^2 + 2\pi(r)(\frac{30}{\pi(r)^2}) \\ &= 2\pi(r)^2 + \frac{60}{r} \end{aligned}$$

38. **The correct answer is 3 and 4.** Using the Pythagorean theorem, write an equation for *x* and *y*:

$$a^2 + b^2 = c^2$$
$$(2x)^2 + (3y)^2 = (5)^2$$
$$4x^2 + 9y^2 = 25$$

Since the sum of the three sides is 12, $2x + 3y + 5 = 12$. Solve this equation for either *x* or *y*:

$$2x + 3y + 5 = 12$$
$$2x + 3y = 7$$
$$2x = 7 - 3y$$
$$x = \frac{7 - 3y}{2}$$

Plug this value into the first equation:

$$\begin{aligned} 4\left(\frac{7-3y}{2}\right)^2 + 9y^2 &= 25 \\ (7-3y)^2 + 9y^2 &= 25 \\ 49 - 42y + 9y^2 + 9y^2 &= 25 \\ 18y^2 - 42y + 24 &= 0 \end{aligned}$$

Solve using the quadratic formula:

$$\begin{aligned} y &= \frac{42 \pm \sqrt{1764 - 4(18)(24)}}{2(18)} \\ &= \frac{42 \pm \sqrt{1764-1728}}{36} \\ &= \frac{42 \pm \sqrt{36}}{36} \\ &= \frac{42 \pm 6}{36} \\ &= \frac{4}{3}, 1 \end{aligned}$$

Plug these values into an equation for *x*:

$$\begin{aligned} x &= \frac{7-3y}{2} \\ &= \frac{7-3(1)}{2} \\ &= 2 \\ x &= \frac{7-3\left(\frac{4}{3}\right)}{2} \\ &= \frac{3}{2} \end{aligned}$$

Calculate the lengths of the legs of the triangle:

$$\begin{aligned} 2x &= 2(2) \\ &= 4 \\ 2x &= 2\left(\frac{3}{2}\right) \\ &= 3 \\ 3y &= 3(1) \\ &= 3 \\ 3y &= 3\left(\frac{4}{3}\right) \\ &= 4 \end{aligned}$$

The lengths of the legs of the triangle are 3 and 4.

39. **The correct answer is A.** The algebraic combination $\left[\frac{f}{g}\right](x)$ is defined to be $\frac{f(x)}{g(x)}$, provided $g(x) \neq 0$. According to the tables, $f(2) = 2$, and $g(2) = 3$. Now divide to find the product:

$$\begin{aligned} \left[\frac{f}{g}\right](2) &= \frac{f(2)}{g(2)} \\ &= \frac{2}{3} \end{aligned}$$

40. **The correct answer is E.** Solve the second equation for q in terms of p:

$$\begin{aligned} 2p + q &= 6 \\ 2p - 2p + q &= 6 - 2p \\ q &= 6 - 2p \end{aligned}$$

Plug this value into the first equation:

$$\begin{aligned} 3p^2 + 2pq - 4q^2 &= 14 \\ 3p^2 + 2p(6 - 2p) - 4(6 - 2p)^2 &= 14 \\ 3p^2 + 12p - 4p^2 - 4(36 - 24p + 4p^2) &= 14 \\ 3p^2 - 4p^2 - 16p^2 + 12p + 96p - 144 &= 14 \\ -17p^2 + 108p - 144 &= 14 \\ -17p^2 + 108p - 158 &= 0 \end{aligned}$$

Solve using the quadratic formula:

$$\begin{aligned} p &= \frac{-108 \pm \sqrt{11664 - 4(-17)(-158)}}{2(-17)} \\ &= \frac{-108 \pm \sqrt{11664 - 10744}}{-34} \\ &= \frac{-108 \pm \sqrt{920}}{-34} \\ &\approx 2.28, 4.07 \end{aligned}$$

Plug these values into an equation for q:

$$\begin{aligned} q &= 6 - 2p \\ &= 6 - 2(2.28) \\ &= 1.44 \\ q &= 6 - 2(4.07) \\ &= -2.14 \end{aligned}$$

42. **The correct answer is C.** The algebraic combination $\left[\frac{3f}{2g}\right](x)$ is defined as $\frac{3f(x)}{2g(x)}$, provided $g(x) \neq 0$. Plug x = 3 into the equation for $f(x)$, then multiply through by 3 to find $3f(3)$:

$$\begin{aligned} f(x) &= 2x^2 + 6x - 7 \\ 3g(3) &= 3(2(3))^2 + 6(3) - 7) \\ &= 3(2(9)) + 18 - 7) \\ &= 3(18 + 18 - 7) \\ &= 3(29) \\ &= 87 \end{aligned}$$

Now plug x = 3 into the equation for $g(x)$, then multiply through by 2 to find $2g(3)$:

$$\begin{aligned} g(x) &= 3x^2 - 4x + 12 \\ 2g(3) &= 2(3(3))^2 - 4(3) + 12) \\ &= 2(3(9)) - 12 + 12) \\ &= 2(27 - 12 + 12) \\ &= 2(27) \\ &= 54 \end{aligned}$$

Now divide to find the quotient:

$$\left[\frac{3f}{2g}\right](3) = \frac{3f(x)}{2g(x)}$$
$$= \frac{87}{54}$$
$$= \frac{29}{18}$$

42. **The correct answer is B.** Solve the inequality as if it were an equation. Remember that when dividing or multiplying by a negative number, the inequality sign changes direction:

$$\begin{aligned} |4-5p| &\le 24 \\ 4-5p &\le 24 \\ -5p &\le 20 \\ p &\ge -4 \end{aligned}$$

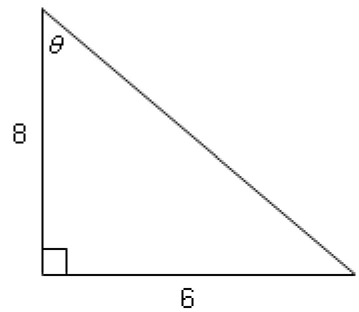
Since the problem involves an absolute value, there is a second inequality to solve:

$$\begin{aligned} 4-5p &\ge -24 \\ -5p &\ge -28 \\ p &\le \frac{28}{5} \end{aligned}$$

43. **The correct answer is A.** The composition function $[f \circ g](x)$ is defined as $f(g(x))$. According to the table, $g(2) = 4$. Now look on the table for $f(x)$ to find $f(4)$, which is equal to –2. Thus:

$$\begin{aligned} [f \circ g](2) &= f(g(2)) \\ &= f(4) \\ &= -2 \end{aligned}$$

44. **The correct answer is D.** Draw a diagram to illustrate the situation:



Use the trigonometric identity $\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$:

$$\tan(\theta) = \frac{6}{8}$$
$$\tan^{-1}(\tan(\theta)) = \tan^{-1}\left(\frac{3}{4}\right)$$
$$\theta = 36.87°$$

45. **The correct answer is A.** Multiply the first equation through by –3:

$$2x + 4y = 20$$
$$-3(2x + 4y = 20)$$
$$-6x - 12y = -60$$

Multiply the second equation through by 2:

$$3x - 5y = 26$$
$$2(3x - 5y = 26)$$
$$6x - 10y = 52$$

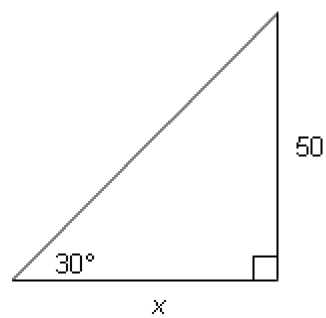
Add the two resulting equations together, canceling out the *x* terms. Then solve for *y*:

$$\begin{aligned} -6x - 12y &= -60 \\ \underline{+6x - 10y} &\underline{= 52} \\ -22y &= -8 \\ y &= \frac{8}{22} \\ &= \frac{4}{11} \end{aligned}$$

Plug this value into either of the original equations and solve for *x*:

$$\begin{aligned}2x+4y&=20\\2x+4\left(\frac{4}{11}\right)&=20\\2x+\frac{16}{11}&=\frac{220}{11}\\2x&=\frac{204}{11}\\x&=\frac{102}{11}\end{aligned}$$

46. **The correct answer is A.** Draw a diagram to illustrate the situation:



Use the trigonometric identity $\tan(\theta)=\dfrac{\text{opposite}}{\text{adjacent}}$:

$$\begin{aligned}\tan(30°)&=\frac{50}{x}\\\frac{1}{\sqrt{3}}&=\frac{50}{x}\\x&=50\sqrt{3}\\&\approx 86.6\end{aligned}$$

47. **The correct answer is A.** Use the addition formula for the sine function:

$$
\begin{aligned}
\sin(\alpha+\beta) &= \sin(\alpha)\cos(\beta)+\cos(\alpha)\sin(\beta)\\
\sin(75°) &= \sin(45°+30°)\\
&= \sin(45°)\cos(30°)+\cos(45°)\sin(30°)\\
&= \left(\frac{\sqrt{2}}{2}\right)\left(\frac{\sqrt{3}}{2}\right)+\left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{2}\right)\\
&= \frac{\sqrt{6}}{4}+\frac{\sqrt{2}}{4}\\
&= \frac{\sqrt{6}+\sqrt{2}}{4}
\end{aligned}
$$

48. **The correct answer is B.** The result after decreasing by 25% is equal to 0.75*x*. Decreasing this number by 10% is equivalent to multiplying 0.75*x* by 1.1, which is equal to 0.825x.