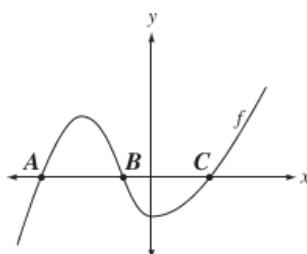## Unit 1 – Transformations of Functions

1 If the graph of $f(x) = (x - 2)^2 + 1$ is transformed into the graph of $g(x) = f(x - 4) + 3$, then the coordinates of the vertex on the graph of $y = g(x)$ will be

A. (2, 4)   C. (6, 4)

B. (–2, 4)   D. (–6, 4)

2

The partial graph of the function $y = f(x)$ is shown below.

Which of the following transformations will **always** create invariant points at A, B, and C?

A. $y = f(bx)$ C. $y = f(x) + k$

B. $y = af(x)$ D. $y = f(x - h)$

3 *When compared to the graph of $y = f(x)$, the graph of $8y = f(-x)$ has been reflected in the _____i_____ and vertically stretched about the x-axis by a factor of _____ii_____ .*

The statement above is completed by the information in row

Row	i	ii	Row	i	ii
A.	y-axis	8	C.	x-axis	8
B.	y-axis	$\frac{1}{8}$	D.	x-axis	$\frac{1}{8}$

4 *The function $f(x) = |x - 2| + 3$ is transformed into the function $g(x) = |x + 2| + 1$. The transformations that will transform $y = f(x)$ into $y = g(x)$ are a translation of*

_____ *units* _____ *and a translation of* _____ *units* _____ .

Use the following code to complete the sentence above.

Numerical Response

Reference Number	Numerical Value
1	1
2	2
3	3
4	4

Reference Number	Translation Direction
5	left
6	right
7	up
8	down

The graphs of the functions $y = f(x)$ and $y = g(x)$ are shown below. Each function is then horizontally stretched by a factor of 2 about the y-axis, resulting in the new functions $y = p(x)$ and $y = q(x)$ respectively. The domain and the range of each of the new functions are found in the table below.
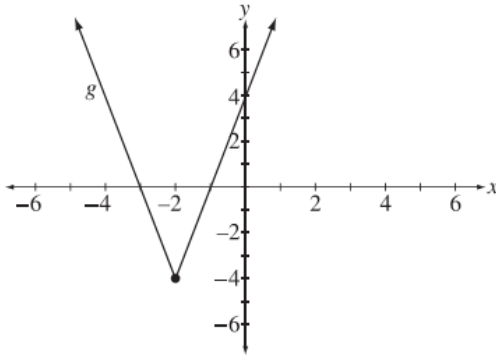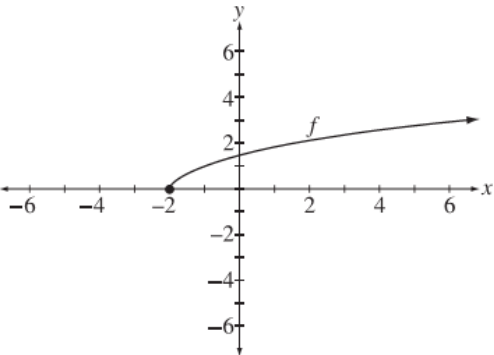
Reference Number	Possible Domain
1	$x \geq -1$
2	$x \geq -2$
3	$x \geq -4$
4	$x \in R$

Reference Number	Possible Range
5	$y \geq 0$
6	$y \geq -2$
7	$y \geq -4$
8	$y \geq -8$
9	$y \in R$

5

Complete the statements below.

The domain and range of the new function $y = p(x)$ are numbered, respectively,

_____ and _____.
Record in the **first** column   Record in the **second** column

The domain and range of the new function $y = q(x)$ are numbered, respectively,

_____ and _____.
Record in the **third** column   Record in the **fourth** column

Numerical Response

[ ][ ][ ][ ]

The point $A(3, -5)$ lies on the graph of the function $y = f(x)$. The ordered pairs below represent possible coordinates of the new point corresponding to Point A after $f(x)$ undergoes a single transformation.

Point 1   (3, 5)

Point 2   (–3, 5)

Point 3   (–3, –5)

Point 4   (–5, –3)

Point 5   (–5, 3)

Point 6   (5, –3)

6

The corresponding point when the graph of $y = f(x)$ is reflected about the line

$y = x$ is Point _____ (Record in the **first** column)
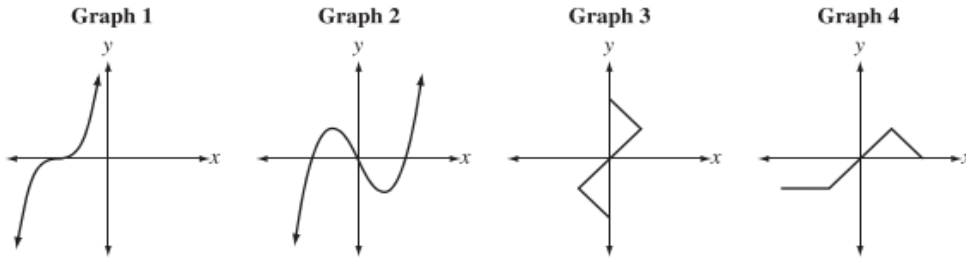
$x = 0$ is Point _____ (Record in the **second** column)

$y = 0$ is Point _____ (Record in the **third** column)

Numerical Response

[ ][ ][ ]

7

A student is asked to draw the inverse of each of the following graphs.
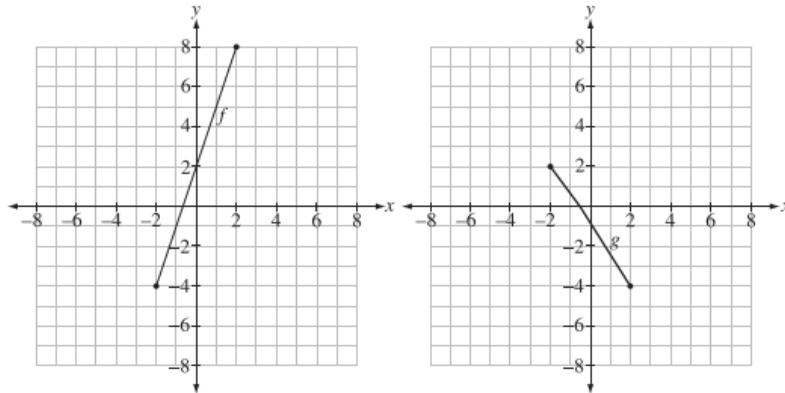
| Graph 1 | Graph 2 | Graph 3 | Graph 4 |

If no additional restrictions are given, which two graphs above will have an inverse that is a function?

A.   Graph 1 and Graph 2   C.   Graph 2 and Graph 3
B.   Graph 1 and Graph 3   D.   Graph 2 and Graph 4

8

The graphs of $y = f(x)$ and $y = g(x)$ are shown below.

The range of the graph of $h(x) = (f - g)(x)$ would be

A. $\{y \mid 0 \leq y \leq 6, y \in R\}$ C. $\{y \mid -6 \leq y \leq 12, y \in R\}$

B. $\{y \mid -6 \leq y \leq 0, y \in R\}$ D. $\{y \mid -12 \leq y \leq 6, y \in R\}$

9

Use the following information to answer the next question.

The graph of $y = f(x)$ is reflected in the x-axis, stretched vertically about the x-axis by a factor of $\frac{1}{3}$, and stretched horizontally about the y-axis by a factor of 4 to create the graph of $y = g(x)$.
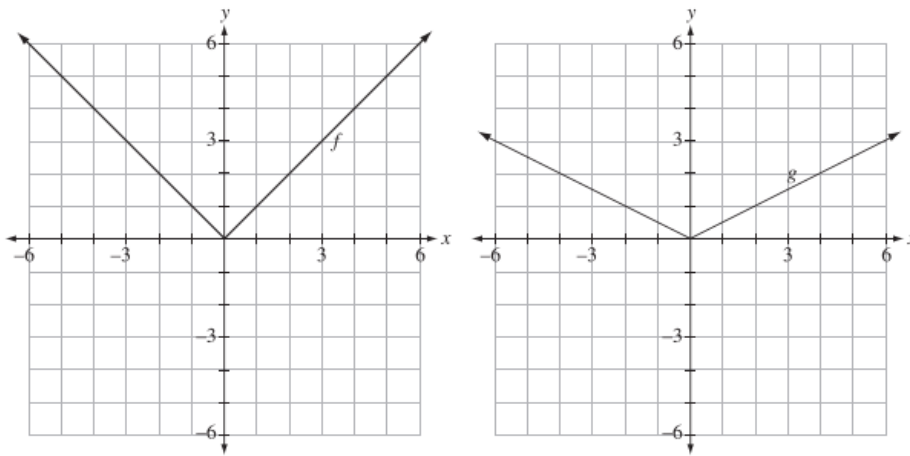
For Point $A(-3, 6)$ on the graph of $y = f(x)$, the corresponding image point, A', on the graph of $y = g(x)$ is

A.   (9, 24)
B.   (−12, −18)
C.   (1, 24)
D.   (−12, −2)

10.

The graphs of $f(x) = |x|$ and $y = g(x)$ are shown below. The graph of $f(x)$ undergoes a single transformation to become the graph of $g(x)$.
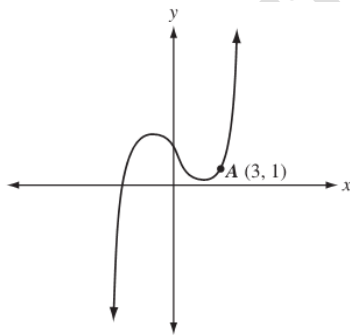

Determine both possible equations for the function $g(x)$.

Written Response

11.

The graph of function f is shown below.

Function f is transformed to create function g.

If $g(x) - 2 = f(x + 5)$, then which quadrant contains Point A in the graph of function g?

A.	Quadrant I	**C.**	Quadrant III
B.	Quadrant II	**D.**	Quadrant IV

12.

The graph of $y = \sqrt{x}$ is transformed into the graph of $y = \sqrt{-\frac{1}{2}x - 4}$.

A list of possible transformations is shown below.

Reference Number	Transformation
1	Horizontal stretch by a factor of $\frac{1}{2}$
2	Horizontal stretch by a factor of 2
3	Reflection in the x-axis
4	Reflection in the y-axis

5	Horizontal translation of 4 left
6	Horizontal translation of 4 right
7	Horizontal translation of 8 left
8	Horizontal translation of 8 right

The transformations from the list above that describe the changes to the graph of $y = \sqrt{x}$ are _____, _____, and _____.
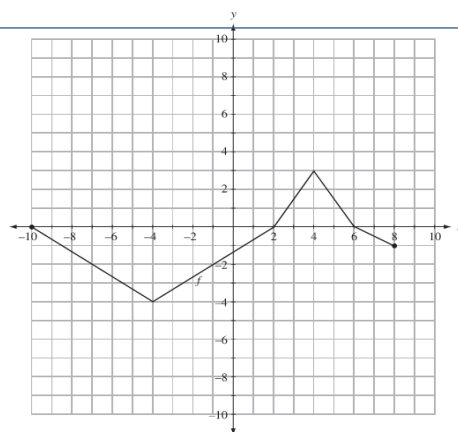
Numerical Response

13.

The graph of $y = f(x)$ as shown is reflected in the y-axis, vertically stretched by a factor of 2 about the x-axis, horizontally stretched by a factor of ½ about the line $x = 0$, and then translated 3 units up.

> **SE**

Sketch the graph of the new function.

> **Written Response**

Numerical Response

Numerical Response

The values of a and b are, respectively, _____ and _____.

15. The graph of $y = f(x)$ is shown

When the graph of $y = f(x)$ is reflected in the line $y = x$, the number of invariant points is

A.   one
B.   two
C.   three
D.   four
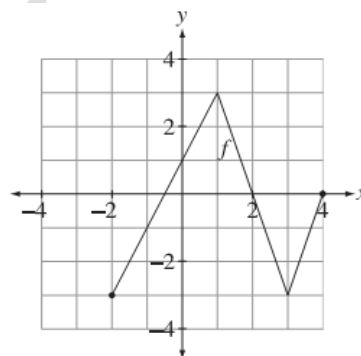
Unit 2 – Function Operations

The table shown below describes the function $y = f(x)$ and the graph shows the function $y = g(x)$.

x	$f(x)$
−1	undefined
0	4
1	5
2	6
3	6
4	7
5	8

16. If $h(x) = \dfrac{f(x)}{g(x)}$, then the value of $h(3)$ is _____

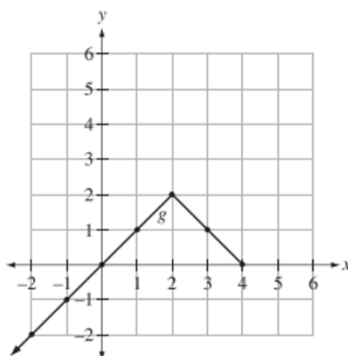**17.**

$$h(x) = g(x) + (f \circ g)(x), \quad \text{where} \quad f(x) = x^2 + 6x \quad \text{and} \quad g(x) = \frac{1}{x-2}$$
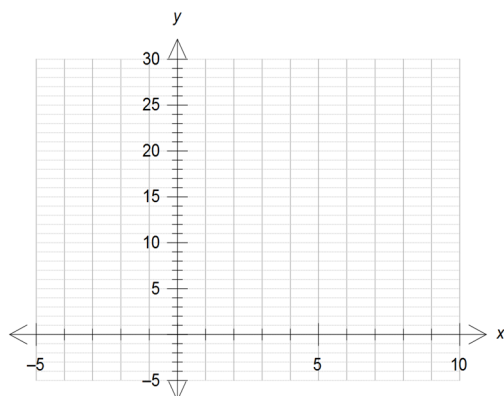
Numerical Response

The value of $h(5)$, to the nearest hundredth, is _____.

18. Given the functions $f(x) = 7 - x$ and $g(x) = 2x + 1$, sketch the graph of $h(x)$ for each question below **and** state the domain and range.

a) $h(x) = f(x)g(x)$
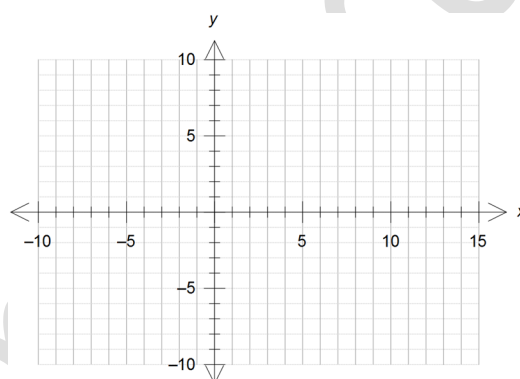
b) $h(x) = \left(\dfrac{g}{f}\right)(x)$

c) $h(x) = g(f(x))$
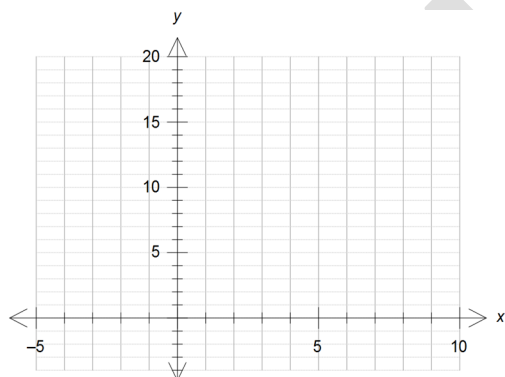
Use the following information to answer the next question.

For functions $f(x) = \sqrt{x-1}$, $g(x) = x^2 + 3$, $h(x) = 2x - 5$, and $k(x)$, where $k(x) = (h \circ g \circ f)(x)$, the simplified expression for $k(x)$ can be written in the form $k(x) = ax - b$.

19. The value of a is _____ (Record in the **first** box)

The value of b is _____ (Record in the **second** box)

Numerical Response

Alex is given the following list of functions, where $b > 1$. She is asked to determine a new function, $h(x)$, which is the quotient of two different functions below and where the domain of $h(x)$ is $\{x \in R\}$.

Function 1	$y = x - b$
Function 2	$y = x^2 + b$
Function 3	$y = x^3 + b$
Function 4	$y = \log_b x$
Function 5	$y = b^x$
Function 6	$y = \sqrt{x + b}$

Numerical Response

20.

If $h(x) = \dfrac{f(x)}{g(x)}$ and Alex selects Function 1 for $f(x)$, then the two functions that she could

select for $g(x)$ are numbered _____ and _____.

Two functions are shown below.

$$f(x):\{(1,4), (2,6), (3,5), (4,2)\}$$

$$g(x):\{(1,5), (3,2), (5,8), (6,3)\}$$

21.   The value of $(g \circ f)(3)$ is

A.   6
B.   8
C.   9
D.   10

22.   Given $f(x) = x^2 - 7x$, $g(x) = x - 2$, and $h(x) = \dfrac{2x^2 + x}{x - 2}$, determine a simplified equation   **Written Response**

for $j(x)$, given that $j(x) = \dfrac{f(x)}{g(x)} + h(x)$.

23.   Given that Point A (3, 4) lies on the graph of $g(x)$, and Point A' (3, 8) lies on the graph   **Written Response**
of $h(x)$, where $h(x) = (f \circ g)(x)$, the corresponding point that lies on the graph of $f(x)$
must be _____ .

Given that $f(x) = \sqrt{x-3}$ and $g(x) = \dfrac{x^2}{x^2 - 25}$, students are asked to select the domain of the graph of $y = h(x)$, where $h(x) = g(f(x))$, from the list provided in the table below.

Reference Number	Domain
2	$\{x \mid x \geq 3,\ x \in R\}$
3	$\{x \mid x \neq 28,\ x \in R\}$
4	$\{x \mid x \geq 3,\ x \neq 28,\ x \in R\}$
5	$\{x \mid x \geq 3,\ x \neq 5,\ x \in R\}$
6	$\{x \mid x \geq 3,\ x \neq 5,\ x \neq 28,\ x \in R\}$

Numerical Response

24. The reference number that corresponds to the domain of the graph of $h(x) = g(f(x))$ is _____ .

Unit 3 – Exponential Functions and Logarithms

25. The graph of $y = 3^{x+2}$ is reflected in the line $y = x$. The equation of the new graph is

A. $y = \log_3 x - 2$

B. $y = \log_3 x + 2$

C. $y = \log_3(x - 2)$

D. $y = \log_3(x + 2)$

26.

A student is asked to solve the equation $\dfrac{125^{x(x+1)}}{5^{(3x-4)}} = 25^{(x-5)}$ using an algebraic process.

She is able to simplify the equation to the form $3x^2 + bx + c = 0$.

The value of c is

A. 6

B. 9

C. 14

D. 40

27. The solution to the equation $8^{(3x+4)} = 4^{(x-9)}$ is

A. $\dfrac{-13}{2}$

B. $\dfrac{-30}{7}$

C. $\dfrac{-17}{5}$

D. $\dfrac{-22}{7}$

28. The equation $m\log_p n + 5 = q$ can be written in exponential form as

A. $p^{(q-5)} = mn$

B. $p^{(q-5)} = n^m$

C. $p^{(q-5)} = \dfrac{m}{n}$

D. $p^{(q-5)} = m^n$

29.

Use the following information to answer the next question.

A student sketched the graphs of $f(x) = \log_a(x+3) - 7$ and $g(x) = a^{(x-2)} + 5$, where $a > 1$, on a coordinate plane. She also drew the asymptotes of the two graphs using dotted lines.

The intersection point of the two dotted lines will be at

A. $(3, 5)$

B. $(-3, 5)$

C. $(2, -7)$

D. $(-2, -7)$

30. The partial graph of the logarithmic function $f(x) = a\log_b(x - h)$, where $b > 1$, is shown below.
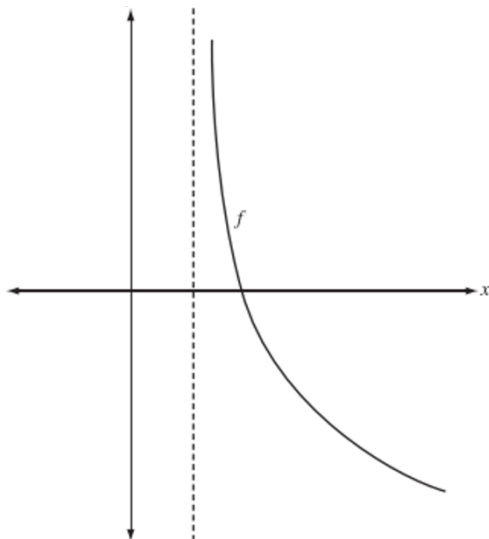
To produce the graph of $y = f(x)$ above, the values of a and h in the function must satisfy

A. $a < 0$ and $h > 0$

B. $a < 0$ and $h < 0$

C. $a > 0$ and $h > 0$

D. $a > 0$ and $h < 0$

31.

The loudness of a sound is related to the logarithm of the ratio of the measured intensity, I, to a reference intensity, I_0. The loudness, L, of a sound is measured in decibels, dB, and can be determined using the following formula.

$$L = 10 \log_{10}\left(\frac{I}{I_0}\right)$$

During an international soccer tournament in 2010, a noisemaker called the vuvuzela had a measured loudness of 127 dB at full volume.

If the intensity of the sound of the vuvuzela is 5 000 times greater than the intensity of the sound of a lawn mower, then the measured loudness of the lawn mower, to the nearest decibel, is

A.   3 dB
B.   37 dB
C.   90 dB
D.   123 dB

32. An expression that is equivalent to $\log\left(\dfrac{2\sin x}{\sin(2x)}\right)$, where $0° < x < 90°$, is

A. $\log 1$
B. $\log(\cos x)$
C. $-\log(\sin x)$
D. $-\log(\cos x)$

33. | SE | Solving the equation $3^{(2x+1)} = \left(\dfrac{1}{5}\right)^{(x-3)}$ algebraically, the solution, to the nearest hundredth, is _____.

Numerical Response

34. If $\log_a 8 = 3$ and $\log_4 b = \dfrac{3}{2}$, then the value of $\log_a b + \log_b a$, to the nearest hundredth,

is _____.

Numerical Response

35. | SE | Solve algebraically $\log_7(x+1) + \log_7(x-5) = 1$.

Written Response

36. The population of a particular town on January 1, 2008 was 15 000. If the population of this town on January 1, 2016 was 32 450, what is the average annual rate of increase?

    A. 0.1%
    B. 1.1%
    C. 10%
    D. 110%

37. If $\log_a b = 1.26$, where $a, b > 0$, $a \neq 1$, then the value of $\log_a\left(\sqrt[3]{b}\right)$, to the nearest hundredth, is _____ .

38. Jordan needs $6 000 to take his family on a trip. He is able to make an investment which offers an interest rate of 8%/a compounded semi-annually. How much should Jordan invest now, to the nearest dollar, so that he has enough money to go on a family trip in 3 years?

Unit 4 – Polynomial Functions

39. For the polynomial function $P(x) = 2x^5 + 3x^4 - 10x^3 - 21x^2 + kx$, two of the zeros are –1 and –2. It can be determined that the largest zero of this function, to the nearest tenth, is _____ .
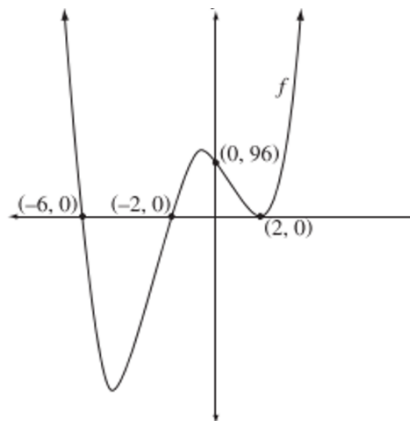
40. The graph of a particular function is shown below. ◆

If the equation of the function graphed above is written in the form $f(x) = ax^4 + bx^3 + cx + d$, then the value of a is

    A. 1
    B. 2
    C. 4
    D. 96

(–6, 0)   (–2, 0)   (0, 96)   (2, 0) f

41. If $P(x)$ is a polynomial function where $P\left(-\frac{2}{3}\right) = 0$ and $P(0) = 12$, then ___*i*___ is a factor of $P(x)$, and ___*ii*___ is a constant term in the equation of $P(x)$.

The statement above is completed by the information in row

Row	*i*	*ii*
A.	$(3x - 2)$	12
B.	$(3x + 2)$	12
C.	$(3x - 2)$	-12
D.	$(3x + 2)$	-12

42.

Use the following information to answer the next question.

> The roots of the equation $2x^3 - 3x^2 - 10x + 3 = 0$ can be written as
>
> $x = m$ and $x = \dfrac{n \pm \sqrt{p}}{4}$, where $m, n, p \in I$.

Numerical Response

The value of p is _____ .

Use the following information to answer the next question.

> The graph of the polynomial function $y = f(x)$ is shown below. The equation of this graph can be written in the form $y = -\dfrac{1}{a}(x - 1)(x + b)(x - c)^2$.
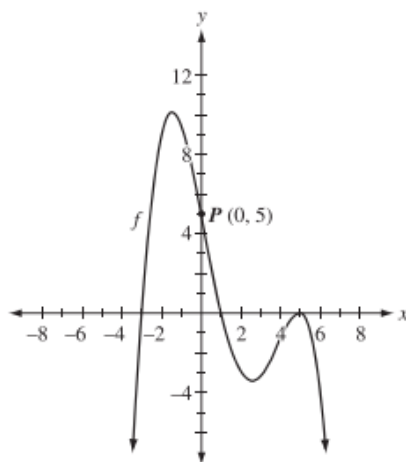
Numerical Response

43.

The value of a is _____ .

44. The polynomial function $P(x) = 4x^4 - x^3 - 8x^2 - 40$ has a linear factor of $x + 2$.

The remaining cubic factor is

A. $4x^3 + 7x^2 + 6x - 20$
B. $4x^3 + 7x^2 + 6x + 12$
C. $4x^3 - 9x^2 + 10x - 20$
D. $4x^3 - 9x^2 + 10x - 60$

45.

Use the following information to answer the next question.

> The binomial $x + 2$ is a factor of $f(x) = x^3 + 3x^2 + kx + 4$.

The value of k is _____. **Numerical Response**

46. Fully factor: $P(x) = 2x^4 + 3x^3 - 17x^2 - 27x - 9$

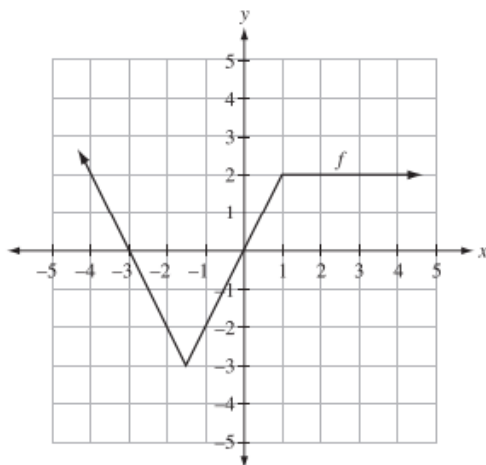**Written Response**

Unit 5 – Radical & Rational Functions

47.

Use the following information to answer the next question.

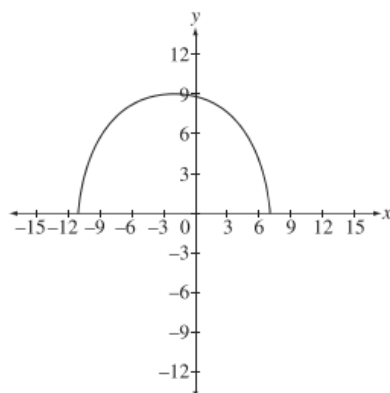**Written Response**

The graph of the function $y = f(x)$ is shown below.

Sketch the graph of $y = \sqrt{f(x)}$ and state the domain and range.

48.

The graph of $y = \sqrt{f(x)}$ has a range of $[0, 9]$ as shown below.

If $f(x)$ is a quadratic function, then a point which **cannot** be on the graph of $y = f(x)$ is

A. $(-14, -63)$ **B.** $(-7, 56)$ **C.** $(4, 90)$ **D.** $(9, -40)$

Use the following information to answer the next question.

The graphs of the functions $y = f(x)$, $y = g(x)$, and $y = h(x)$ are shown below. Each function is transformed into $y = \sqrt{f(x)}$, $y = \sqrt{g(x)}$, and $y = \sqrt{h(x)}$, respectively.
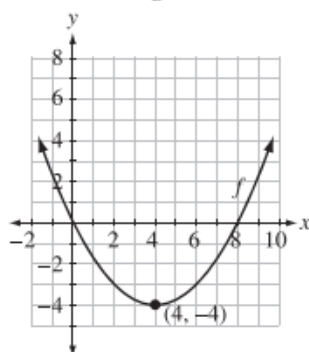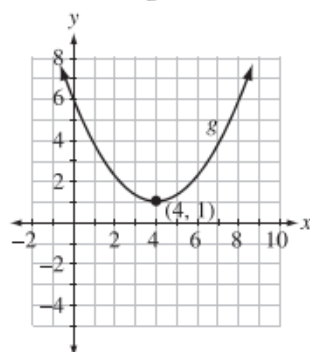
Diagram 1   **Diagram 2**   **Diagram 3**
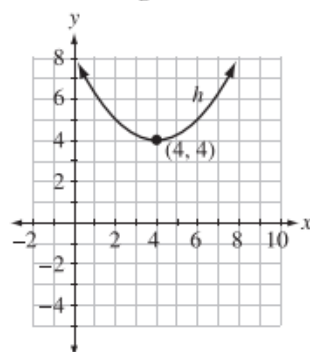
49. The number of invariant points on the original graph and its transformed graph for

Diagram **1** is _____   **Numerical Response**

Diagram **2** is _____

Diagram **3** is _____

Use the following information to answer the next question.

The graph of the function $f(x) = \frac{1}{2}x - 3$ is transformed into $y = \sqrt{f(x)}$. The invariant points of the graph are located as (a, b) and (c, d).

50. The values of $a, b, c,$ and d are, respectively, _____, _____, _____, and _____.   **Numerical Response**

51. **Numerical Response**

For the function $f(x) = y = -2\sqrt{x+4} + 3$, the x-intercept is equal to $-k$. The value of k, to the nearest hundredth, is _____.

52. Sketch the graph of the following functions and determine the following characteristics for each function below: domain, x- and y-intercepts, and the equation of the vertical asymptote.

Written Response

a) $y = \dfrac{3x}{x^2 + 2x - 8}$
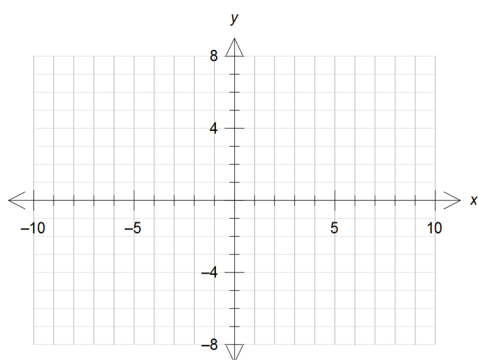
b) $y = \dfrac{x+3}{x^2 - 9}$
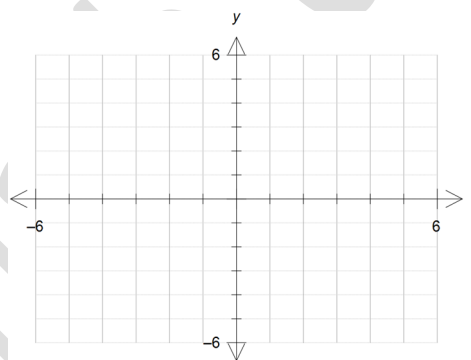
53. If $f(x) = \dfrac{1}{x+1} + 3$, then the vertical asymptote is located at _____ and the horizontal asymptote is located at _____.   **Numerical Response**

Use the following code to complete the sentence above.

Possible Equations

1 $x = -3$	3 $x = 1$	5 $y = -3$	7 $y = 1$
2 $x = -1$	4 $x = 3$	6 $y = -1$	8 $y = 3$

54.

The graph of the function $f(x) = \dfrac{3x^2 - 11x - 4}{(x-4)(x+4)}$ has a point of discontinuity at (m, n).

The value of n is

A. -11

B. 0

C. $\dfrac{11}{8}$

D. $\dfrac{13}{8}$

55. Determine the coordinates of the point of discontinuity on the graph of $f(x) = \dfrac{2x^2 - 15x + 7}{x - 7}$.

56. For a function $f(x) = \dfrac{(3x - 2)(2x + 3)}{(1 - x)(3x - 2)}$ the vertical and horizontal asymptotes are given in row:

ROW	Vertical Asym.	Horizontal Asym.
A.	$x = 2/3$	$y = -2$
B.	$x = 1$	$y = -3$
C.	$x = 2/3$	$y = -3$
D.	$x = 1$	$y = -2$

Unit 6 – Trigonometry ◀❂☑✚❖♥

A dog is tied to the corner of a rectangular garage. He is given enough leash to run along a 20.0 m circular path, completing $\frac{3}{4}$ of a circle, as shown in the diagram below.
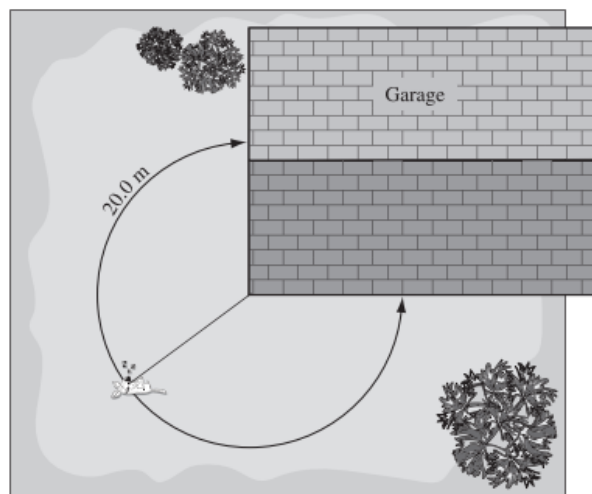
Numerical Response

57.   The length of the dog's leash, to the nearest tenth of a metre, is _____ m.

58. An angle, in radians, that is co-terminal with 30° is

A. $-\dfrac{5\pi}{6}$

B. $-\dfrac{13\pi}{6}$

C. $\dfrac{7\pi}{6}$

D. $\dfrac{25\pi}{6}$

59. An angle, θ, in standard position, is shown below.

The best estimate of the rotation angle θ is

- **A.** 1.25 radians
- **B.** 3.12 radians
- **C.** 4.01 radians
- **D.** 5.38 radians

60. The unit circle is shown below with an angle, θ, in standard position. Point $P(k, 0.6)$ is on the terminal arm.
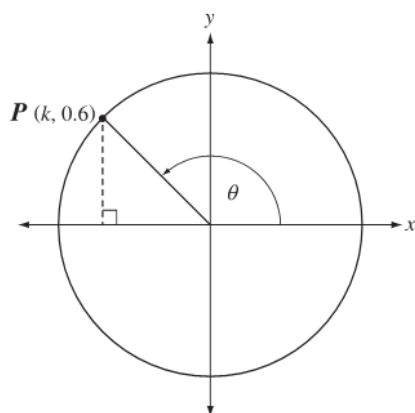
The value of k is _____*i*_____ *, and the **exact** value of $\sec\theta$ is* _____*ii*_____ .

The statement above is completed by the information in row

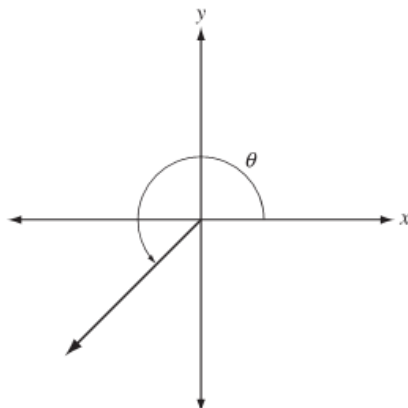| Row	*i*	*ii*
A.	−0.8	$-\dfrac{5}{4}$
B.	−0.8	$-\dfrac{5}{3}$
C.	0.8	$-\dfrac{5}{4}$
D.	0.8	$-\dfrac{5}{3}$

61.

The terminal arm of an angle of 70° in standard position intersects the unit circle at the point $P(x, y)$. The coordinates of Point $P(x, y)$, rounded to the nearest hundredth, are $x = 0.ab$ and $y = 0.cd$.

Numerical Response

The value of x is 0._____ (Record in the **first and second** columns.)

The value of y is 0._____ (Record in the **third and fourth** columns.)

62. On a unit circle, Point $P\left(-\dfrac{5}{13}, \dfrac{12}{13}\right)$ lies on the terminal arm of angle θ in standard position.

What are the exact values of the 6 trigonometric ratios for angle θ?

63. If $\sin\theta = -2\cos\theta$ and $\frac{\pi}{2} \le \theta \le \pi$, then the **exact** value of $\tan(2\theta)$ is

A. $\frac{4}{3}$ 　　　　C. $-\frac{4}{3}$

B. $\frac{4}{5}$ 　　　　D. $-\frac{4}{5}$

64. The terminal arm of θ, when drawn in standard position, contains the point $P(x, y)$ where P is on the unit circle. If $\sin\theta = \frac{7}{10}$ and $\tan\theta < 0$, then what is the value of x?

A. $-\frac{\sqrt{51}}{10}$ 　　　　C. $\frac{3}{10}$

B. $\frac{\sqrt{51}}{10}$ 　　　　D. $-\frac{3}{10}$

65. Point $A\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$ and Point $B\left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$ lie on the terminal arm of two different angles in standard position on the circle. The angle, θ, where $0 < \theta < \pi$, can be expressed in the form $\frac{m\pi}{n}$.

The values of **m** and **n** are, respectively, _____ and _____.

Numerical Response
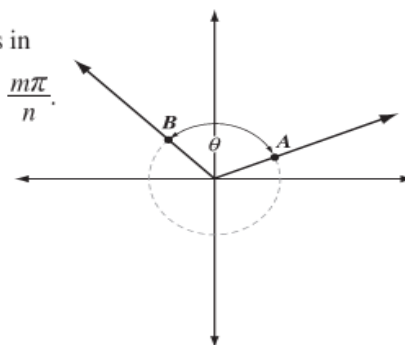
66. The **exact** value of $\sin\left(-\frac{\pi}{6}\right) + \cos\left(\frac{7\pi}{4}\right)$ is

A. $\frac{\sqrt{2}-1}{2}$ 　　　　C. $\frac{\sqrt{3}+\sqrt{2}}{2}$

B. $\frac{\sqrt{2}+1}{2}$ 　　　　D. $\frac{\sqrt{3}-\sqrt{2}}{2}$

67. Given that $\csc\theta = \frac{8}{5}$, where $\frac{\pi}{2} < \theta < \pi$, **Written Response** determine the **exact** value of $\tan\theta$.

68. If $\cos(x - 20°) = \frac{1}{2}$, where $0° < x < 90°$, then the value of x, to the nearest degree,

is _____°.

69.

For the angles $\frac{\pi}{6}$, $\frac{5\pi}{6}$, $\frac{7\pi}{6}$, and $\frac{11\pi}{6}$, the following statements are given.

Statement 1   These angles in degrees are, respectively, 30°, 150°, 210°, and 300°.

Statement 2   They are all part of the solution set $\theta = \frac{\pi}{6} + 2n\pi$, $n \in I$.

Statement 3   The values of $\sin\left(\frac{7\pi}{6}\right)$ and $\cos\left(\frac{5\pi}{6}\right)$ are both negative.
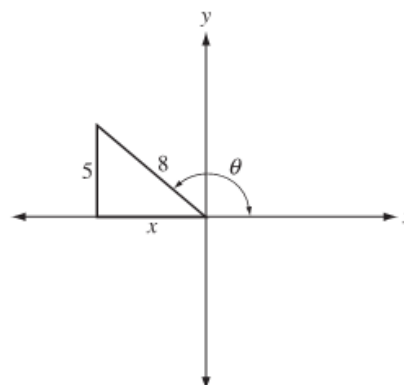
Numerical Response

The statement that is true from the list above is number _____.

70. If $\csc\theta = \frac{2}{\sqrt{3}}$, where $0 \le \theta < 2\pi$, then θ lies in Quadrant ___*i*___ , and

$\cot\theta$ is equal to ___*ii*___ .

ROW	*i*	*ii*
A.	I or II	$\pm\sqrt{3}$
B.	I or IV	$\pm\sqrt{3}$
C.	I or II	$\pm 1/\sqrt{3}$
D.	I or IV	$\pm 1/\sqrt{3}$

71. The partial graph of $f(x) = a\sin\left[b(x - c)\right] + d$, where $a > 0$ and x is in radians, is shown below. Two of its maximum points and two of its minimum points are labelled.

The minimum positive value of c, to the nearest hundredth of a radian, is

A.   1.05

B.   1.57

C.   2.09

D.   2.62

$\left(\frac{-7\pi}{6}, 1.5\right)$ $\left(\frac{5\pi}{6}, 1.5\right)$ $\left(\frac{-\pi}{6}, -5.5\right)$ $\left(\frac{11\pi}{6}, -5.5\right)$
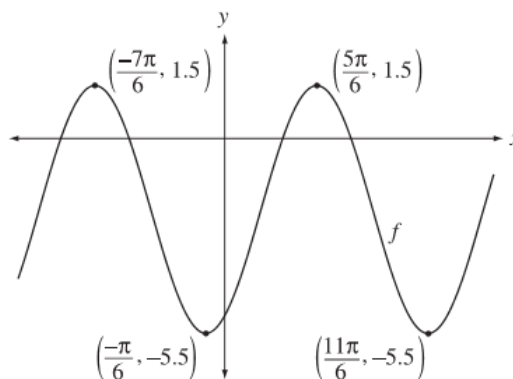
72. A local park with a radius of 195 m has a circular running trail surrounding it, as shown below. The shortest distance from the running trail to the parking lot is 5 m. At a constant speed, Ellie can complete 4 full laps around the park in 32 minutes. Ellie's distance from the parking lot as she runs, s, in metres, as a function time, t, in minutes, can be represented by the function

$$s(t) = a\cos[b(t - c)] + d.$$

The values of **b** and **d** in the function are, respectively,

A. $\frac{\pi}{16}$ and 195

B. $\frac{\pi}{16}$ and 200

C. $\frac{\pi}{4}$ and 195

D. $\frac{\pi}{4}$ and 200

Parking lot

5 m

Running trail

Radius
195 m

Park

---

73. *A function is represented by the equation* $y = \sin(3x + \pi) + 7$. *The value of the phase shift is* ___*i*___ *and the period of the corresponding graph is* ___*ii*___ .
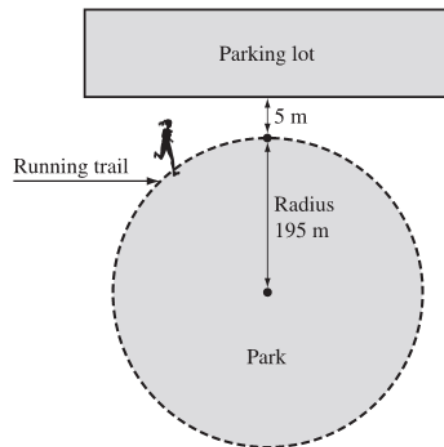
The statement above is completed by the information in row

Row	i	ii
A.	π	3
B.	π	$\frac{2\pi}{3}$
C.	$\frac{\pi}{3}$	$\frac{2\pi}{3}$
D.	$\frac{\pi}{3}$	3

---

74. The partial graph of the cosine function below has a minimum point at $\left(\frac{\pi}{2}, -2\right)$ and a maximum point at $(\pi, 8)$ as shown below. The equation of the function can be expressed in the form $y = a\cos(b(x - c)) + d$, $a, b, c, d \in W$.
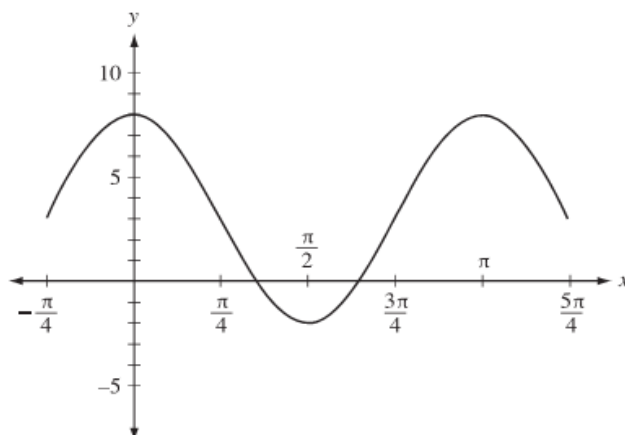
Numerical Response

With a minimum possible phase shift, the values of **a, b, c,** and **d** are, respectively,

_____, _____, _____, and _____.

75. An incorrect solution to the equation $\cos\theta = \dfrac{\cos\theta}{\csc\theta}$, where $0° \le \theta < 360°$, is shown below.

The step that records the **first** mistake in the solution is

A. Step 2
B. Step 3
C. Step 4
D. Step 5

Step 1	$\cos\theta = \cos\theta\left(\dfrac{1}{\csc\theta}\right)$
Step 2	$1 = \dfrac{1}{\csc\theta}$
Step 3	$\csc\theta = 1$
Step 4	$\cos\theta = 1$
Step 5	$\theta = 0°, 180°$

76. The non-permissible values of θ for the identity $\dfrac{1-\sin^2\theta}{1-\cos^2\theta} = \dfrac{\cos^2\theta}{\sin^2\theta}$ are

A. $n\pi,\ n\in I$ C. $\dfrac{\pi}{2}+n\pi,\ n\in I$

B. $2n\pi,\ n\in I$ D. $\pi+2n\pi,\ n\in I$

77. If the identity $\dfrac{\sin x}{1-\cos x} = \dfrac{1+\cos x}{\sin x}$ is verified using $x = \dfrac{2\pi}{3}$, then the **exact** value of each side is

A. $-\sqrt{3}$ C. $-\dfrac{\sqrt{3}}{3}$

B. $\sqrt{3}$ D. $\dfrac{\sqrt{3}}{3}$

78. The steps shown below were used to determine the complete solution set to the equation $3\sin^2 x + \cos^2 x + 5\sin x - 4 = 0$, where $0 \le x < 2\pi$.

The **first** recorded error is in Step

A. 1
B. 2
C. 4
D. 6

Step 1	$2\sin^2 x + \sin^2 x + \cos^2 x + 5\sin x - 4 = 0$
Step 2	$2\sin^2 x + 1 + 5\sin x - 4 = 0$
Step 3	$2\sin^2 x + 5\sin x - 3 = 0$
Step 4	$(2\sin x - 1)(\sin x + 3) = 0$
Step 5	$\sin x = \dfrac{1}{2}$ or $\sin x = -3$
Step 6	$x = \left\{\dfrac{\pi}{6}\right\}$

79. The values of θ, where $180° \le \theta < 360°$, in the equation $2\cos^2\theta + \cos\theta = 0$, are

    A. $\theta = 90°, 120°$

    B. $\theta = 240°, 270°$

    C. $\theta = 60°, 90°, 270°, 300°$

    D. $\theta = 90°, 120°, 240°, 270°$

80. Determine a general solution of $\cot^2\theta - 1 = 0$, expressed in radians.
    Written Response

81. Determine the solution set for the equation $2\cos^2 x + \sin x - 1 = 0$, where $-\pi \le x \le \pi$.
    Written Response

82.

Use the following information to answer the next question.

A Mathematics 30–1 class was asked to determine a general solution to the equation $2\sin\theta\cos\theta - \cos\theta = 0$, in degrees. The answers provided by four different students are shown below.

    Student 1 $\theta = 60° + n(120°), \; n \in I$

    Student 2 $\theta = 90° + n(360°), \; n \in I$, and $\theta = 30° + n(120°), \; n \in I$

    Student 3 $\theta = n(180°), \; \theta = 60° + n(360°)$, and $\theta = 300° + n(360°), \; n \in I$

    Student 4 $\theta = 90° + n(180°), \; \theta = 30° + n(360°)$, and $\theta = 150° + n(360°), \; n \in I$

The two students who provided a correct general solution are numbered

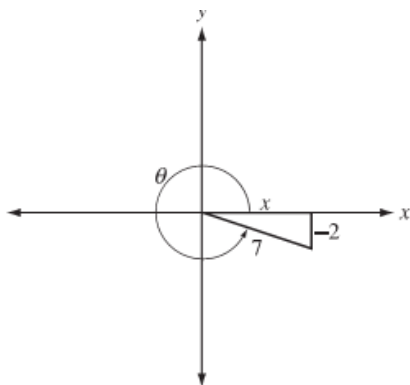   **A.** 1 and 3   **C.** 2 and 3

    B. 1 and 4   **D.** 2 and 4

83. Graphically solve for θ, where $-180° \le \theta \le 0°$, given $\left(2 - \sqrt{3}\sec\theta\right)\left(\sec\theta + 3\right) = 0$. State answers to the nearest degree.

84. Given that $\sin\theta = -\dfrac{2}{7}$ and $\cot\theta < 0$, determine the **exact** value of $\cos\left(\theta - \dfrac{2\pi}{3}\right)$.

Unit 7 – Perms, Combs, and Binomial Theorem

85.

A soccer team plays six games in one month. Each game results in a win, loss, or tie.

For this soccer team, how many different sets of results are possible for the six games?

A. 729   C. 216

B. 720   D. 64

86.

Prior to 2010, standard licence plates in Alberta consisted of 3 letters followed by 3 digits, and standard Ontario licence plates consisted of 4 letters followed by 3 digits. Letters and digits can be repeated on licence plates. There are 23 letters in the alphabet that can be used, as the letters I, O, and Q are not allowed. All of the digits from 0 to 9 may be used. An example of each licence plate is shown below.

Numerical Response

In 2009, the number of standard licence plates possible in Ontario was r times greater than the number of standard licence plates possible in Alberta. The value of r as a whole number is _____.

87. The identification code on a bank card consists of 1 digit followed by 2 letters. The code must meet the following conditions:

- The digit must be odd.
- The letters A, E, I, O and U cannot be used.
- Letters cannot be used more than once.

The number of possible identification codes that can be created with these conditions is _____.

Numerical Response ☐☐☐☐

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88. A 6 person health council must be created from a group of 8 doctors and 40 nurses. The expression that represents the number of different councils that contain at most 2 doctors is

A. $\left({}_{40}P_6\right)+\left({}_{8}P_1\right)\left({}_{40}P_5\right)+\left({}_{8}P_2\right)\left({}_{40}P_4\right)$

B. $\left({}_{40}C_6\right)+\left({}_{8}C_1\right)\left({}_{40}C_5\right)+\left({}_{8}C_2\right)\left({}_{40}C_4\right)$

C. $\left({}_{40}P_5\right)\left({}_{8}P_1\right)+\left({}_{40}P_4\right)\left({}_{8}P_2\right)$

D. $\left({}_{40}C_5\right)\left({}_{8}C_1\right)+\left({}_{40}C_4\right)\left({}_{8}C_2\right)$

89.

> In a local high school, from a group of 16 students comprised of 7 singers and 9 actors, a 6-person executive council is selected.

How many different executive councils are possible if the council must include **at least** 4 actors?

A. 336

B. 2 646

C. 3 528

D. 3 612

---

90. The binomial $(2x+3)^{(a-5)}$ has 7 terms. The value of a is ____*i*____ and the coefficient on the first term is ____*ii*____ .

The statement above is completed by the information in row

ROW	*i*	*ii*
A.	11	64
B.	11	128
C.	12	64
D.	12	128

---

91. In the expansion of $\left(x^3+\dfrac{1}{2x^2}\right)^8$ written in descending powers of x, the sixth term is

A. $\dfrac{28}{x}$

B. $\dfrac{7}{4x}$

C. $\dfrac{1}{64x^6}$

D. $\dfrac{7}{16x^6}$

92. In the expansion of $(3a - b^2)^{10}$, what is the coefficient of the term containing $a^4 b^{12}$?

A. −17 010

C. 630

B. −630

D. 17 010

93. In the expansion of the binomial $\left(2a + \dfrac{1}{a}\right)^8$, the constant term is _____.

94.

There are 6 terms in the expansion of $(x + 4)^n$.

The value of n is ____i____ , and the value of the constant term in the expansion is ____ii____ .

The statement above is completed by the information in row

Row	i	ii
A.	5	1 024
B.	5	4 096
C.	6	1 024
D.	6	4 096

ANSWERS

1. C

2. B

3. B

4. 4528 *or* 2845

5. 3547

6. 531

7. B

8. C

9. D

10. $g(x) = \left|\frac{1}{2}x\right|$ *or* $g(x) = \frac{1}{2}|x|$

11. B

12. 247

13. ↓

(−2, 9)
(−1, 3)   (5, 3)
(−4, 1)
(2, −5)

14. 13

15. B

16. 6

17. 2.44

18. *Go to website*

19. 21

20. 25

21. B

22. $h = 3x$

23. (4, 8)

24. 4

25. A

26. C

27. B

28. B

29. B

30. A

31. C

32. D

33. 0.98

34. 3.33

35. $x = 6$

36. C

37. 0.42

38. $4742

39. 2.5

40. A

41. B

42. 17

43. 15

44. C

45. 4

46. $P(x) = (x+1)(x-3)(2x+1)(x+3)$

47. D: $x \le -3$, or $x \ge 0$
R: $y \ge 0$

48. C

49. 410

50. 6081 *or* 8160

51. 1.75

52. *See on website*

53. 28

54. D

55. (7, 13)

56. D

57. 4.2

58. D

59. C

60. A

61. 3494

62. $\sin\theta = \frac{12}{13}$; $\cos\theta = -\frac{5}{13}$; $\tan\theta = -\frac{12}{5}$; $\csc\theta = \frac{13}{12}$; $\sec\theta = -\frac{13}{5}$; $\cot\theta = -\frac{5}{12}$

63. A

64. A

65. $m = 7, n = 12$

66. A

67. Since θ is a second quadrant angle, $x = -\sqrt{39}$.
Therefore, $\tan\theta = -\frac{5}{\sqrt{39}}$ or $\tan\theta = -\frac{5\sqrt{39}}{39}$.

68. 80

69. 3

70. C

71. A

72. D

73. C

74. 5203

75. A

76. A

77. D

78. D

79. B

80. $x = \frac{\pi}{4} + \frac{n\pi}{2}; n\epsilon I$

81. $\frac{-5\pi}{6}, \frac{-\pi}{6}, \frac{?}{2}$

82. D

83. −109° and −30°

84. $\frac{-3\sqrt{5} - 2\sqrt{3}}{14}$

85. A

86. 23

87. 2100

88. B

89. D

90. A

91. B

92 D

93. 1120

94. A