Precalculus Final Exam Review

1. Anna and Zach each have $600 to invest. Anna's investments earn a rate of 10.5%, and Zach's investments earn a rate of 6.5%. ***Approximately***, how much more money will Anna have than Zach when Zach's investments are worth $900? (Assume continuous compounding.)

   A $184

   B $241

   C $255

   D $264

2. A solution's pH is given by the function $p(t) = -\log(t)$, where t is the hydronium ion concentration, in moles per liter. A sample of coffee has a pH of 5.0. What is the ***approximate*** hydronium ion concentration of the sample?

A 0.000001

B 0.00001

C 0.0001

D 0.001

3. The value of an account that is being compounded continuously is given by the formula $A = Pe^{rt}$, where P is the principal, r is the annual interest rate, and t is the time in years. ***Approximately*** how long will it take for the amount of money to double if the interest rate is 2.4%?

A 11.0 years

B 12.9 years

C 20.0 years

D 28.9 years

4. The table below represents the size, in acres, of the average farm.

Year	1950	1960	1970	1980	1997	1998
Size of Farm (acres)	213	297	374	426	436	435

- Choose which mathematical model below ***best*** fits the data.
- Using the model, predict the ***approximate*** size of the average farm in the year 2010.

A linear; 650 acres

B linear; 510 acres

C quadratic; 400 acres

D quadratic; 360 acres

5. Which function results by shifting the graph of $y = \ln(x + 3) - 6$ to the left 4 units and down 3 units?

A $y = \ln(x + 7) - 9$

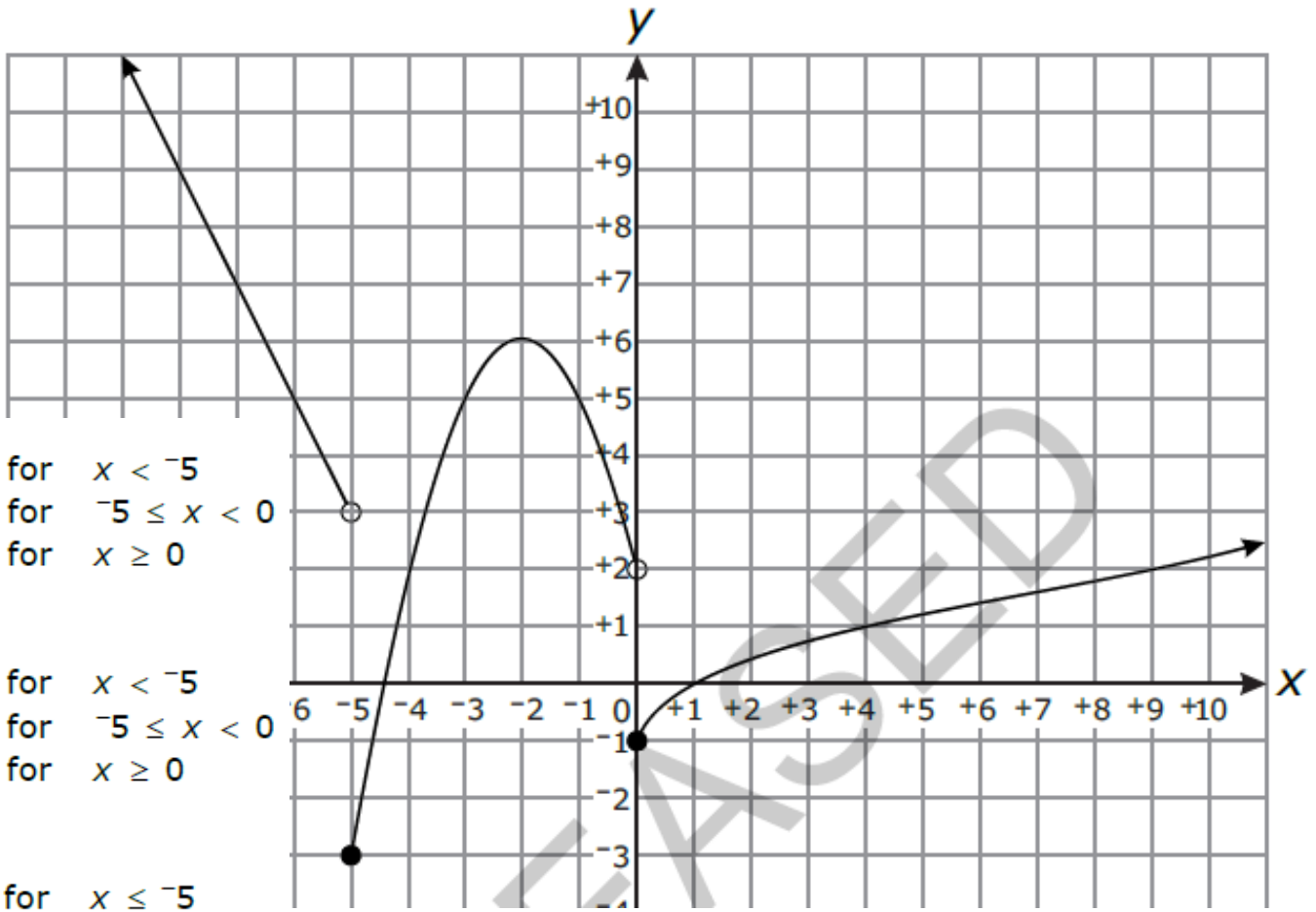
B $y = \ln(x - 1) - 9$

C $y = \ln(x + 7) - 3$

D $y = \ln(x - 1) - 3$

Which piecewise function is graphed below?

6.



A $f(x) = \begin{cases} -2x - 7 & \text{for } x < -5 \\ -(x + 2)^2 + 6 & \text{for } -5 \le x < 0 \\ \sqrt{x} - 1 & \text{for } x \ge 0 \end{cases}$

B $f(x) = \begin{cases} -2x - 7 & \text{for } x < -5 \\ -(x - 2)^2 + 6 & \text{for } -5 \le x < 0 \\ \sqrt{x - 1} & \text{for } x \ge 0 \end{cases}$

C $f(x) = \begin{cases} -2x - 7 & \text{for } x \le -5 \\ -(x - 2)^2 + 6 & \text{for } -5 < x \le 0 \\ \sqrt{x - 1} & \text{for } x > 0 \end{cases}$

D $f(x) = \begin{cases} -2x - 7 & \text{for } x \le -5 \\ -(x + 2)^2 + 6 & \text{for } -5 < x \le 0 \\ \sqrt{x} - 1 & \text{for } x > 0 \end{cases}$

7. A function, $f(x)$, is shown below.

$$f(x) = \begin{cases} x - 4 & \text{for } 0 \le x < 2 \\ x^2 - 3x + 4 & \text{for } 2 \le x < 4 \\ 5 & \text{for } 4 \le x < 7 \end{cases}$$

What is the range of $f(x)$?

A $[^-4, 5)$

B $[^-4, 8)$

C $[^-4, ^-2) \cup [2, 5)$

D $[^-4, ^-2) \cup [2, 8)$

8. A water tower is located 410 feet from a building. From a window in the building, it is observed that the angle of elevation to the top of the tower is 42 degrees and the angle of depression to the bottom of the tower is 25 degrees. ***Approximately*** how tall is the water tower?

A 191 feet

B 369 feet

C 448 feet

D 560 feet

9. Given the table below:

x	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π	$\frac{5\pi}{4}$	$\frac{3\pi}{2}$
y	0.5	0	$^{-}0.5$	0	0.5

Which function fits the data?

A $y = 0.5\cos(2x - \pi)$

B $y = 0.5\cos(x - \pi)$

C $y = 0.5\cos\left(2x + \frac{\pi}{2}\right)$

D $y = \cos\left(2x + \frac{\pi}{2}\right)$

10. How does the graph of $g(x) = 0.5\cos(2x)$ differ from the graph of its parent function, $f(x) = \cos(x)$, over the interval $^{-}\pi \leq x \leq \pi$?

A The amplitude is smaller, and the period is shorter.

B The amplitude is smaller, and the period is longer.

C The amplitude is larger, and the period is shorter.

D The amplitude is larger, and the period is longer.

11. What are the zeros of $y = \frac{x^2 - 2x - 3}{x^2 + 5x - 14}$?

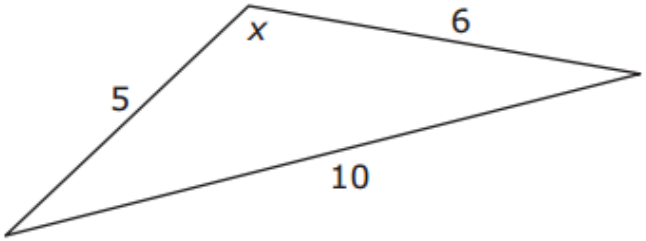
A 3 and $^{-}1$

B 1 and $^{-}3$

C 7 and $^{-}2$

D 2 and $^{-}7$

12. What is the ***approximate*** measure of angle x in the triangle below?



A 60.3°

B 80.4°

C 117.1°

D 130.5°

13. A Ferris wheel is designed in such a way that the height (h), in feet, of the seat above the ground at any time, t, is modeled by the function $h(t) = 60 - 55\sin\left(\frac{\pi}{10}t + \frac{\pi}{2}\right)$.

What is the ***maximum*** height a seat reaches?

A 55 feet

B 60 feet

C 110 feet

D 115 feet

14. Suppose the function $H(t) = 8.5\sin(0.017t - 1.35) + 12$ models the hours of sunlight for a town in Alaska, where $t = 1$ is the first day of the year. Based on the function, what is the ***approximate*** range of daylight hours for the town?

A 3.5 to 20.5

B 4 to 20

C 4.5 to 19.5

D 5 to 19

15. The surface area of a balloon can be represented by the function $S(r) = 4\pi r^2$, where r is the radius of the balloon. If r increases with time, t, and is represented by the function $r(t) = \frac{1}{4}t^2$, what is the surface area of the balloon expressed as a function of time?

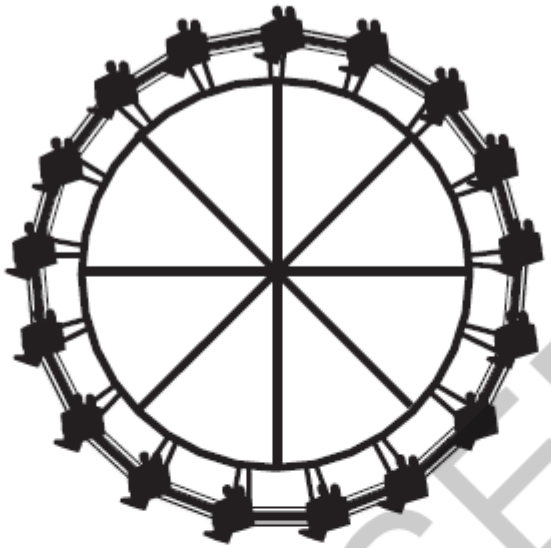
A $S(t) = 4\pi t^2$

B $S(t) = \pi t^2$

C $S(t) = \frac{\pi t^4}{4}$

D $S(t) = \frac{\pi^2 t^2}{16}$

16. A Ferris wheel has a diameter of 80 feet. Riders enter the Ferris wheel at its lowest point, 5 feet above the ground, at time $t = 0$ seconds. One complete rotation takes 65 seconds.



Which function models a rider's vertical height, $h(t)$, at t seconds?

A $h(t) = -80\cos\left(\frac{2\pi}{65}t\right) + 5$

B $h(t) = -40\cos\left(\frac{2\pi}{65}t\right) + 45$

C $h(t) = -45\cos\left(\frac{65}{2\pi}t\right) + 40$

D $h(t) = -5\cos\left(\frac{65}{2\pi}t\right) + 80$

17. A piecewise function is shown below.

$$h(x) = \begin{cases} -2x^2 + 5x + 10 & \text{for } -4 \le x < 3 \\ 2x + 3p & \text{for } 3 \le x \le 5 \end{cases}$$

For what value of p will the function be continuous?

A $\frac{10}{3}$

B $\frac{1}{3}$

C $\frac{-25}{3}$

D $\frac{-34}{3}$

18. Which equation is equivalent to $3 \log x + \log 2 = \log 3x - \log 2$?

A $\log x^3 + 2 = \log (3x - 2)$

B $\log (3x + 2) = \log (3x - 2)$

C $\log 6x = \log \left(\frac{3x}{2}\right)$

D $\log (2x^3) = \log \left(\frac{3x}{2}\right)$

19. The equation $y = 4.7x^{\frac{1}{6}}$ is graphed on the coordinate plane. How does increasing the denominator of the exponent transform the graph?

A The transformed graph will approach a horizontal asymptote while the original graph will not.

B The transformed graph will not approach a horizontal asymptote while the original graph will.

C The transformed graph will go to ∞ slower than the original graph as the value of x gets larger.

D The transformed graph will go to ∞ faster than the original graph as the value of x gets larger.

20. Which function has an amplitude that is twice the size and a period that is three times the size of the function $y = 3\cos\left(\frac{x}{4} - 1\right) + 2$?

A $y = 6\sin\left(\frac{x}{12} - 3\right) + 1$

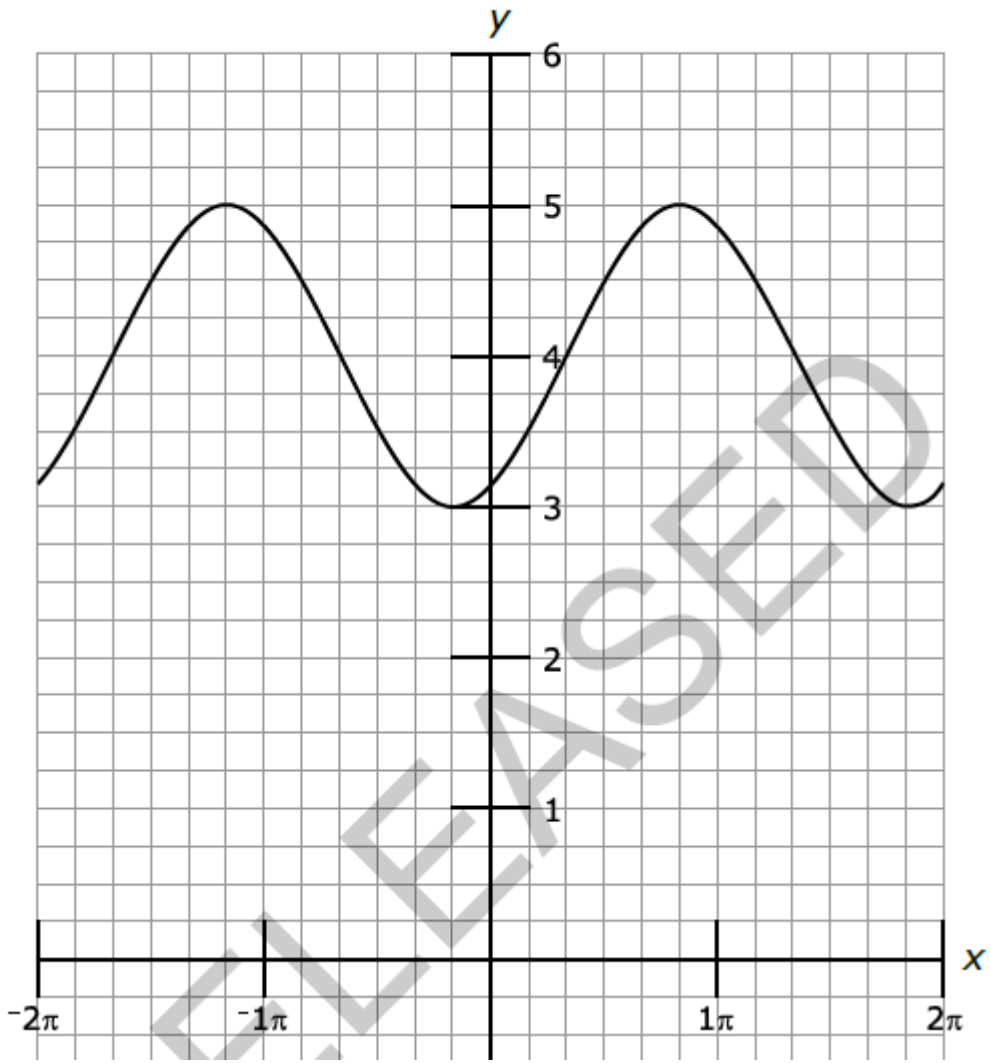
B $y = \frac{3}{2}\cos\left(\frac{3x}{4} + 1\right) - 3$

C $y = 6\cos\left(\frac{3x}{4} - 1\right) + 3$

D $y = \frac{3}{2}\sin\left(\frac{x}{12} + 3\right) - 1$

Which function correctly represents the graph below?

21.



A $y = \sin\left(x - \frac{\pi}{3}\right) + 4$

B $y = \sin\left(x + \frac{\pi}{3}\right) + 4$

C $y = \cos\left(x - \frac{\pi}{3}\right) + 4$

D $y = \cos\left(x + \frac{\pi}{3}\right) + 4$

22. A plane takes off and travels at an angle of 40° north of east at 110 mph for 2 hours. It then adjusts its path to head 10° west of north and travels in that direction for half an hour at a speed of 100 mph. ***Approximately*** how far away is the plane from its starting point?

A 182 miles

B 200 miles

C 238 miles

D 249 miles

23. Which expression is equivalent to $\dfrac{\dfrac{\sin(\theta)}{\cos(\theta)} + \dfrac{\cos(\theta)}{\sin(\theta)}}{\dfrac{1}{\sin(\theta)}}$?

A $\dfrac{1}{\cos(\theta)}$

B $\sin(\theta)$

C $\cos(\theta)$

D $\dfrac{1}{\sin(\theta)}$

24. If $f(x) = \frac{4}{3}x - 9$, what is $f^{-1}(-3)$?

A -13

B -9.5

C -7

D 4.5

25. Two sides of a triangle measure 14 ft and 17 ft, respectively. The included angle is 72°. ***Approximately*** how long is the third side of the triangle?

A 18.4 ft

B 20.3 ft

C 25.1 ft

D 30.7 ft

26. A series is shown below.

$$\sum_{n=1}^{\infty}(2n-1)$$

Which is true about the series?

A The series converges to $^{-}1$.

B The series converges to 1.

C The series converges to 2.

D The series diverges.

27. A sequence is shown below.

$$36, {}^{-}6, 1, {}^{-}\frac{1}{6}, \frac{1}{36}, \ldots$$

What is the sum of the sequence?

A $\frac{^{-}36}{5}$

B $\frac{36}{7}$

C $\frac{216}{7}$

D $\frac{216}{5}$

28. What are the ***approximate*** rectangular coordinates for the point with polar coordinates (5, 30°)?

A (2.5, 2.89)

B (2.5, 4.33)

C (2.89, 4.33)

D (4.33, 2.5)

29. Two sides of a triangle measure 10 inches and 13 inches. The included angle between these sides is 55°. What is the ***approximate*** measure of the third side of the triangle?

A 10.9 inches

B 11.2 inches

C 13.9 inches

D 16.2 inches

30. What transformations have occurred to create the function $f(x) = 3x^3 - 4$ from the function $g(x) = x^3$?

A The graph of the function has been stretched horizontally and shifted up four units.

B The graph of the function has been stretched vertically and shifted up four units.

C The graph of the function has been stretched horizontally and shifted down four units.

D The graph of the function has been stretched vertically and shifted down four units.

31. Lucy invested \$6,000 into an account that earns 6% interest compounded continuously. ***Approximately*** how long will it take for Lucy's investment to be valued at \$25,000?

A 52.7 years

B 46.9 years

C 24.5 years

D 23.8 years

32. A lamppost is located 418 feet from a building. The angle of elevation from the base of the lamppost to the top of the building is 32.3°. ***Approximately*** how tall is the building?

A 223 feet

B 264 feet

C 510 feet

D 661 feet

33. Two functions are shown below.

$$T(x) = {}^{-}x$$
$$P(x) = 10x + 2$$

What is the value of $P(T(3)) - T(P(3))$?

A 8

B 4

C 0

D $^{-}4$

34. The polar coordinates of a point are $\left(6, \frac{4\pi}{3}\right)$. What are the rectangular coordinates of the point?

A $(3, -3\sqrt{3})$

B $(3, 3\sqrt{3})$

C $(-3, -3\sqrt{3})$

D $(-3, 3\sqrt{3})$

35. What are the polar coordinates of (4, 9)?

A $(\sqrt{97}, 66°)$

B $(\sqrt{97}, 114°)$

C $(\sqrt{13}, 66°)$

D $(\sqrt{13}, 114°)$

36. What is the distance between y-intercepts of the graph of $x + 8 = 2(y + 3)^2$?

A 4

B 6

C 11

D 15

37. Which is a solution set to $x + \frac{3x}{x - 1} = \frac{x + 2}{x - 1}$?

A $\{^{-}1\}$

B $\{^{-}2\}$

C $\{^{-}2, 1\}$

D $\{2, ^{-}1\}$

38. What is the range of the inverse of $y = \tan x$?

A $\frac{-\pi}{2} < y < \frac{\pi}{2}$

B $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$

C $0 < y < \pi$

D $0 \leq y \leq \pi$

39. James is standing 10 meters away from Samantha.

- A bird is located in the sky at a point between where James and Samantha are standing.
- James is looking up at the bird at an angle of elevation of 74°.
- Samantha is looking up at the bird at an angle of elevation of 47°.

Approximately how far is the bird from Samantha?

A 7.6 meters

B 8.5 meters

C 11.2 meters

D 13.1 meters

40. What type of conic section is represented by $r = \frac{8}{16 + 125\sin\theta}$?

A circle

B ellipse

C hyperbola

D parabola

41. Which expression is equivalent to $(\sec\theta)\left(\frac{\sin\theta}{\tan\theta}\right)$?

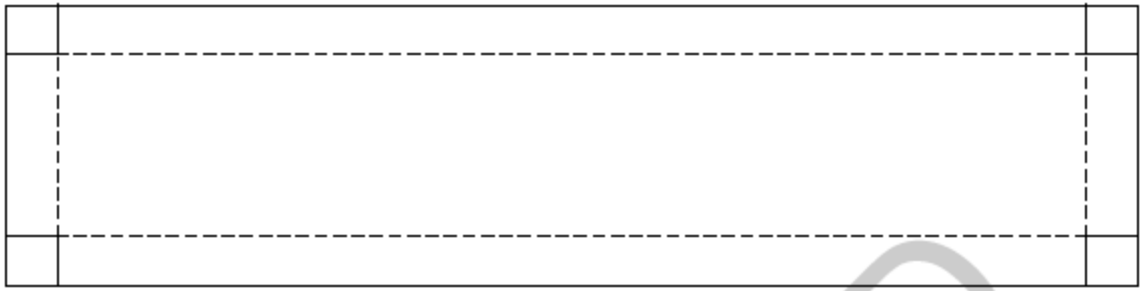
A $\cos^2\theta - \sin^2\theta$

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

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

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

42. James had a rectangular piece of cardboard that was four times as long as it was wide. He wanted to use the cardboard to make a box with no lid. To do this, he first cut a 3-by-3-inch square out of each of the four corners of the piece of cardboard, as shown in the picture below.



Then James folded the cardboard along the four dotted lines shown in the picture. This created an open box with a volume of 336 cubic inches.

What was the width of the sheet of cardboard that James started with?

A 10.5 inches

B 9.5 inches

C 8.5 inches

D 7.5 inches

43. Suppose that for each foot of land along the street, the annual tax is $25 per foot. The diagram below shows a plot of land.

About how much is the annual tax for the plot?

A $1,238

B $1,293

C $1,321

D $1,411

44. An object is launched straight upward from ground level with an initial velocity of 50.0 feet per second. The height, h (in feet above ground level), of the object t seconds after the launch is given by the function $h(t) = -16t^2 + 50t$. At ***approximately*** what value of t will the object have a height of 28.0 feet and be traveling downward?

A 2.39 seconds

B 1.84 seconds

C 1.56 seconds

D 0.73 seconds

45. What is the range of the function $f(x) = -5 - 2(x + 3)^2$?

A $[-5, \infty)$

B $(-\infty, 5]$

C $(-\infty, -5]$

D $(-\infty, \infty)$

46. A wind that is blowing from the northwest toward the southeast can be represented by a vector. The vector has an eastward component and a southward component. If the eastward component has a magnitude of 5.00 miles per hour and the southward component has a magnitude of 15.00 miles per hour, in what direction is the wind blowing?

A The wind is blowing in the direction 71.6° east of south.

B The wind is blowing in the direction 67.5° east of south.

C The wind is blowing in the direction 22.5° east of south.

D The wind is blowing in the direction 18.4° east of south.

47. What value of x satisfies the equation $\log_3(x - 4) = 2$?

A 5

B 10

C 12

D 13

48. The function $C(x) = \frac{2.50x + 1.00}{x}$ models the cost per item for a company to produce x items after the first item is made. What is the inverse function of $C(x)$?

A $C^{-1}(x) = \frac{1.00}{x - 2.50}$

B $C^{-1}(x) = \frac{x - 2.50}{1.00}$

C $C^{-1}(x) = \frac{x - 1.00}{2.50}$

D $C^{-1}(x) = \frac{2.50}{x - 1.00}$

49. From a point 100 feet from the base of a building, Angie looks up at a 40° angle to the top of a building. She walks 20 feet closer to the building. At ***approximately*** what angle must Angie now look up to see the top of the building?

A 32°

B 46°

C 60°

D 77°

50. A computer rental company charges $50 to rent a computer for one week. The table below shows the daily late fees the company charges if a computer is returned late.

Days Late	Daily Late Fee
days 1 through 10	$5
days 11 through 20	$8
days 21 through 30	$10

What would be the total cost of renting a computer for one week and returning it 15 days late?

A $120

B $125

C $140

D $170

51. A sequence is shown below.

$$1, 3, 3^2, 3^3, \ldots$$

How many terms of the sequence must be added together for the sum to equal 3,280?

A 6

B 7

C 8

D 9

52. The first term of an infinite geometric sequence is 2. The sum of the sequence is 6. What is the common ratio of the sequence?

A $\frac{1}{3}$

B $\frac{2}{3}$

C $\frac{3}{3}$

D $\frac{4}{3}$

53. Which is true of the series shown below?

$$\pi + \frac{3\pi}{4} + \frac{9\pi}{16} + \frac{27\pi}{64} + \ldots$$

A The series diverges.

B The series converges to $\frac{3\pi}{2}$.

C The series converges to $\frac{4\pi}{3}$.

D The series converges to 4π.

54. Karen recursively generated a sequence of five positive integers by starting with a positive integer, a_1, and then applying the recursive formula $a_n = a_{n-1} + 3n - 1$ to generate a_n for $n = 2, 3, 4$, and 5.

If the value of a_5 was 407, what was the value of Karen's starting term, a_1?

A 366

B 367

C 368

D 369

55. What is the inverse function of $f(x) = \log_5(2x - 1)$?

A $f^{-1}(x) = 5^x - 1$

B $f^{-1}(x) = \frac{5^x + 1}{2}$

C $f^{-1}(x) = \log_2(5x - 1)$

D $f^{-1}(x) = \log_5 \frac{5x + 1}{2}$

56. What is the value of the limit shown below?

$$\lim_{n \to \infty} \left(\frac{3^n - 1}{3^n} \right)$$

A $\frac{1}{3}$

B $\frac{2}{3}$

C 1

D $+\infty$

57. A piecewise function is shown below.

$$f(x) = \begin{cases} cx + 1, & x \leq 2 \\ cx^2 - 1, & x > 2 \end{cases}$$

For what value of c does $\lim_{x \to 2} f(x)$ exist?

A -2

B -1

C 1

D 4

58. A circle is graphed using the parametric equations shown below.

$$x = 5\cos(t) + 3$$

$$y = 5\sin(t) - 1$$

Where is the center of the circle located?

A $(-3, -1)$

B $(-3, 1)$

C $(3, -1)$

D $(3, 1)$

59. What is the explicit form of the equation $a_n = a_{n-1} + 2(n - 1)$; $a_1 = 1$?

A $a_n = 2n - 1$

B $a_n = n^2 - n + 1$

C $a_n = n^2 - 2n + 2$

D $a_n = 2n^2 - 2n - 1$

60. A series is shown below.

$$1 + \frac{2}{5} + \frac{4}{25} + \frac{8}{125} + \ldots$$

Which statement is true about the sum of the series?

A The series converges to $\frac{7}{3}$.

B The series converges to $\frac{5}{2}$.

C The series converges to $\frac{5}{3}$.

D The series diverges.

61. A man is standing on level ground 50 feet away from the wall of a building. He looks up at a window on the building. The angle of elevation to the bottom of the window is 28.5°. He then looks up at the top of the building. The angle of elevation to the top of the building is 35°. What is the ***approximate*** distance between the bottom of the window and the top of the building?

A 5.7 feet

B 7.9 feet

C 8.3 feet

D 8.5 feet

62. The graph of $y = ax^2$ is shifted up 3 units and right 5 units. Which equation represents the resulting graph?

A $y = a(x - 5)^2 + 3$

B $y = a(x + 5)^2 + 3$

C $y = a(x - 3)^2 + 5$

D $y = a(x + 3)^2 + 5$

63. Triangle *WXY* has the following properties:

- The angle at vertex *W* is 14°, and the angle at vertex *X* is obtuse.
- The side opposite vertex *W* has a length of 7.00 units.
- The side opposite vertex *X* has a length of 9.00 units.

What is the ***approximate*** length of the side opposite vertex *Y*?

A 1.73 units

B 2.08 units

C 3.26 units

D 5.40 units

64. What is the inverse function of $g(x) = x^3 - 2$?

A $g^{-1}(x) = \sqrt[3]{x + 2}$

B $g^{-1}(x) = \sqrt[3]{x - 2}$

C $g^{-1}(x) = \sqrt[3]{x} + 2$

D $g^{-1}(x) = \left(\frac{x - 2}{3}\right)^3$

65.

Consider these two trigonometric functions:

$$f(x) = 3\sin(2x) + 4$$

$$g(x) = 3\sin\left(2x - \frac{\pi}{2}\right) + 4$$

How should the graph of f be shifted to produce the graph of g?

A Shift the graph of f to the left $\frac{\pi}{4}$ units to produce the graph of g.

B Shift the graph of f to the right $\frac{\pi}{4}$ units to produce the graph of g.

C Shift the graph of f to the left $\frac{\pi}{2}$ units to produce the graph of g.

D Shift the graph of f to the right $\frac{\pi}{2}$ units to produce the graph of g.

66. The maximum height, in inches, a ball reaches after its first four bounces is shown in the table below.

Bounce Number	**Height** (in inches)
1	42.0
2	31.5
3	23.6
4	17.7

Which type of function ***best*** models the data and why?

A an exponential function, because the height of the ball is decreasing by 25% with each bounce

B an exponential function, because the height of the ball is decreasing by 75% with each bounce

C a logistic function, because the height of the ball is decreasing by 25% with each bounce

D a logistic function, because the height of the ball is decreasing by 75% with each bounce

67. What are the polar coordinates of the point $(^{-}2\sqrt{3}, 2\sqrt{3})$, where $0 \leq \theta \leq 360$?

A $(2\sqrt{6}, 150°)$ and $(^{-}2\sqrt{6}, 210°)$

B $(2\sqrt{6}, 135°)$ and $(^{-}2\sqrt{6}, 315°)$

C $(2\sqrt{6}, 120°)$ and $(^{-}2\sqrt{6}, 240°)$

D $(2\sqrt{6}, 30°)$ and $(^{-}2\sqrt{6}, 330°)$

68. Which equation is the rectangular form of the polar equation $r = \frac{2}{1 + \cos\theta}$?

A $x^2 + 4y = 4$

B $x^2 + y^2 = 4$

C $y^2 + 4x = 4$

D $y^2 - 4x = 4$

69. Two parametric equations are shown below, where $t \geq 0$.

$$x = \frac{1}{3}\sqrt{t} + 3$$
$$y = 4t^2 - 7$$

Which nonparametric equation can be used to graph the curve described by the parametric equations?

A $y = \frac{4}{9}(x + 1) - 7$

B $y = \frac{4}{3}(x + 3) - 7$

C $y = 36(x - 1)^4 - 7$

D $y = 324(x - 3)^4 - 7$

70. Which is the inverse of $f(x) = 1.5^x + 4$?

A $f^{-1}(x) = \frac{x - 4}{1.5}$

B $f^{-1}(x) = \frac{\log(x) - 4}{1.5}$

C $f^{-1}(x) = \frac{\log(x - 4)}{\log(1.5)}$

D $f^{-1}(x) = \frac{4 - \log(x)}{\log(1.5)}$

71. The formula for a sequence is shown below.

$$a_n = 2a_{n-1} + 3,\ a_1 = 3$$

Which is another formula that represents the sequence?

A $f(n) = 3(2^n - 1)$

B $f(n) = 2n^3 - 3n^2 + 8n + 3$

C $f(n) = 2(n^2 + 1)$

D $f(n) = 3n^2 + 8n - 1$

72. When $a_1 = 25{,}000$, what is the sum of the infinite sequence defined by the equation $a_{n+1} = 0.8a_n$?

A 125,000

B 140,000

C 160,000

D 195,000

73. What is the end behavior of the function $f(x) = \frac{100}{1 + 5(0.75)^x}$?

A $\lim_{x \to -\infty} f(x) = 0$ and $\lim_{x \to \infty} f(x) = \infty$

B $\lim_{x \to -\infty} f(x) = 0$ and $\lim_{x \to \infty} f(x) = 100$

C $\lim_{x \to -\infty} f(x) = 1$ and $\lim_{x \to \infty} f(x) = \infty$

D $\lim_{x \to -\infty} f(x) = 1$ and $\lim_{x \to \infty} f(x) = 100$

74. Which is an equation of a parabola that has a directrix of $y = -5$ and a focus at $(2, -1)$?

A $y = \frac{1}{2}(x + 2)^2 + 2$

B $y = \frac{1}{8}(x + 2)^2 + 3$

C $y = \frac{1}{8}(x - 2)^2 - 3$

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

75. In the piecewise function below, k is a constant.

$$f(x) = \begin{cases} \dfrac{x^2 - k^2}{x - k}, & x \neq k \\ 4 - k, & x = k \end{cases}$$

What is the value of the limit $\lim_{x \to k^-} f(x)$?

A $^{-}2k$

B $2k$

C 0

D Limit does not exist.

76. Which expression is equivalent to $\dfrac{\cos(\theta)}{1 - \sin(\theta)} - \tan(\theta)$?

A $\sec(\theta)$

B $\sin(\theta)$

C $\cos(\theta)$

D $\csc(\theta)$

77. What are the horizontal and vertical asymptotes of $f(x) = \frac{x^2 + 2x + 1}{x^2 + 3x - 4}$?

A $x = 1$ and $y = -1$

B $x = -4$, $y = -1$, and $y = 1$

C $x = \pm 1$ and $y = 0$

D $x = -4$, $x = 1$, and $y = 1$

78. What is the ***approximate*** solution to the equation $3^{x-1} = 4^{2x+5}$?

A 3.875

B 1.262

C -2.354

D -4.797

79. What value of h is needed to complete the square for the equation $x^2 + 10x - 8 = (x - h)^2 - 33$?

A $^{-}25$

B $^{-}5$

C 5

D 25

80. In a geometric sequence, $a_1 = 12$ and $r = \sqrt{2}$. What is the ***approximate*** sum of the first 20 terms of the sequence?

A 339.4

B 8,688.9

C 29,624.9

D 29,636.9

81. What are the vertical asymptotes of $y = \frac{2x^2 - x - 1}{6x^2 - x - 1}$?

A $x = -1, x = \frac{1}{2}$

B $x = -\frac{1}{2}, x = 1$

C $x = -\frac{1}{2}, x = \frac{1}{3}$

D $x = -\frac{1}{3}, x = \frac{1}{2}$

82. A system of equations is shown below.

$$y = |x - 3|$$

$$y = \frac{1}{2}x$$

What is the distance between the points of intersection of the system?

A $\sqrt{6}$

B $\sqrt{20}$

C $\sqrt{48}$

D $\sqrt{80}$

83. What is the ***approximate*** value of the sum:

$$8 - \frac{8}{7} + \frac{8}{49} - \ldots + 8 \bullet \left(\frac{-1}{7}\right)^{2,500} ?$$

(Note: The sum of a series can be calculated using the formula $S_n = \frac{a_1(1 - r^n)}{1 - r}$, where $r \neq 1$.)

A 1

B 7

C 8

D 9

84. What is the domain of $f(x) = \sqrt{-x + 2}$?

A $\{x : x \geq -2\}$

B $\{x : x \leq 2\}$

C $\{x : -2 < x < 2\}$

D $\{x : 0 < x < 2\}$

85. An investment has a balance of \$2,000 and earns 3.2% interest each year. If \$150 is added at the end of each year by the account holder and no money is withdrawn from the investment, which represents a function that can be used to calculate the investment balance for successive years?

A $B_n = 0.032B_{n-1} + 2{,}000,\ B_0 = 150$

B $B_n = 0.032B_{n-1} + 150,\ B_0 = 2{,}000$

C $B_n = 1.032B_{n-1} + 2{,}000,\ B_0 = 150$

D $B_n = 1.032B_{n-1} + 150,\ B_0 = 2{,}000$

86. What is the value of $\lim_{x \to 3} (x^2 - 3x + 7)$?

A -2

B 7

C 25

D Limit does not exist.

87. The temperature, in degrees F, of the water in a large fish tank is modeled by the function $T(x) = \ln(1 + x) + 52.4$, where x is the number of pebbles in the tank. ***Approximately*** how many pebbles are in the tank if the water is 58.3°F?

A 360

B 300

C 270

D 200

88. Which is the solution set for x if $2e^{2x} + 5e^{x} - 12 = 0$?

A $\left\{\ln\frac{3}{2}, \ln 4\right\}$

B $\left\{\ln\frac{3}{2}, \ln^{-}4\right\}$

C $\{\ln 4\}$

D $\left\{\ln\frac{3}{2}\right\}$

89. A function is shown below.

$$f(x) = \begin{cases} -x^2 + 2x & \text{for } x \leq -3 \\ 2\left(\frac{1}{3}\right)^{2x} & \text{for } -3 < x < 4 \\ \frac{2x - 5}{x - 7} & \text{for } x \geq 4 \end{cases}$$

What is the value of the expression $f(-3) + 2f(-1) - f(4)$?

A $\frac{101}{36}$

B $\frac{32}{9}$

C 4

D 22

90. Which function goes to positive ∞ most quickly as x increases?

A $y = \log(x) + 100$

B $y = e^{x-9} - 3$

C $y = x^2 + 5x + 6$

D $y = 3x^5 + 4x^3 - 11x - 6$

91. Which expression is equivalent to $\frac{\sin^4(\theta) - \cos^4(\theta)}{\sin^2(\theta) - \cos^2(\theta)}$, where $\sin^2(\theta) \neq \cos^2(\theta)$?

A $\sin^2(\theta) - \cos^2(\theta)$

B $\cos^2(\theta) - \sin^2(\theta)$

C 2

D 1

92. What is the solution to the equation $\frac{2x - 3}{x - 1} = \frac{8x + 1}{4x + 5}$?

A $\frac{-14}{5}$

B $\frac{-14}{9}$

C $\frac{14}{9}$

D $\frac{14}{5}$

93. A sequence is shown below.

1, 0.1, 0.01, 0.001, 0.0001, . . .

What is the sum of the sequence?

A $1\frac{1}{10}$

B $1\frac{1}{9}$

C $1\frac{2}{9}$

D $1\frac{9}{10}$

94. Astronomers have observed that sunspots vary sinusoidally. The variation is from a minimum of about 10 sunspots per year to a maximum of about 120 per year. A cycle lasts about 11 years. If a minimum occurred in 1964, which function could model the number of sunspots, S, as a function of the year, t?

A $S(t) = -55\cos\left(\frac{2\pi}{11}(t - 1964)\right) + 65$

B $S(t) = -55\cos\left(\frac{2\pi}{11}t - 1964\right) + 65$

C $S(t) = -65\cos\left(\frac{2\pi}{11}(t - 1964)\right) + 55$

D $S(t) = -65\cos\left(\frac{2\pi}{11}t - 1964\right) + 55$

95. The recursive formula for a sequence is $U_n = U_{n-1} + 12$, where U_n is the nth term of the sequence and $U_0 = 7$. Which explicit formula can be used to determine the nth term of the sequence?

A $7n + 19$

B $7n + 12$

C $7 + 19n$

D $7 + 12n$

96. Which statement is true about the sequence shown below?

0, 4.5, 12, 22.5, . . .

A The series converges because the limit of the sequence as n approaches infinity is infinity.

B The series converges because the limit of the sequence as n approaches infinity is 30.

C The series diverges because the limit of the sequence as n approaches infinity is infinity.

D The series diverges because the limit of the sequence as n approaches infinity is 30.

97. Which statement is true about the fifth terms of the two sequences below?

$$a_n = 3n^2 - 6$$

$$b_n = 3(b_{n-1} - 6);\ b_1 = 10$$

A The fifth term of the recursive sequence exceeds the fifth term of the explicit sequence by 63.

B The fifth term of the explicit sequence exceeds the fifth term of the recursive sequence by 63.

C The fifth term of the recursive sequence exceeds the fifth term of the explicit sequence by 21.

D The fifth term of the explicit sequence exceeds the fifth term of the recursive sequence by 21.

98. Which statement is true about the series shown below?

$$^{-}4 + {}^{-}2 + {}^{-}1 + \frac{^{-}1}{2} + \frac{^{-}1}{4} + \ldots$$

A The series converges because $|r| < 1$.

B The series diverges because $|r| < 1$.

C The series converges because $|r| > 1$.

D The series diverges because $|r| > 1$.

99. The third term of a geometric sequence is 96, and the fifth term is 1,536. What is the sum of the first ten terms of this sequence?

A 4,092

B 1,572,864

C 2,097,150

D 33,554,400

100. A sequence is shown below.

6, 12, 20, 30, 42, 56, . . .

Which is the recursive formula for this sequence?

A $t_n = n + 2(t_{n-1} + 1)$

B $t_n = (t_{n-1} + 1)(n - 2)$

C $t_n = 2(t_{n-1} + 2) - (n + 2)$

D $t_n = t_{n-1} + 2(n + 1)$