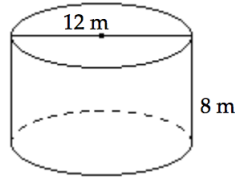# Math 96 - Packet A - Free Response

Question 1. Find the volume of the circular cylinder whose diameter is 12 m and height is 8 m.

Question 2. The sum of two numbers is -2. Three times the first number equals four times the second number. Find the two numbers.

Question 3. A boat moves 5 kilometers upstream in the same amount of time it moves 20 kilometers downstream. If the rate of the current is 9 kilometers per hour, find the rate of the boat in still water.

Question 4. Solve for x.
$$\sqrt[3]{4x - 2} = \sqrt[3]{x + 6}$$

Question 5. The amount of water in a leaky bucket is given by the linear function $f(t) = 125 - 7t$, where $f(t)$ is in ounces and t is in minutes. Find the amount of water in the bucket after 4 minutes.

Solve for x.

Question 6.
$$x^4 + 36 = 37x^2$$

Question 7.
$$\sqrt{4x + 6} - 3 = 0$$

1

Question 8. Graph the piecewise defined function.
$$f(x) = \begin{cases} -4 & \text{if } x \leq -1 \\ -2+x & \text{if } x > -1 \end{cases}$$

Question 9. Solve for x.
$$(4x+2)^2 = 36$$

Question 10. Find the vertex of the graph of the quadratic function.
$$f(x) = -7x^2 - 14x - 5$$

Question 11. Solve for x.
$$\log_{\frac{3}{5}} x = 2$$

Question 12. Graph the function and state the vertex.
$$f(x) = -5x^2$$

Question 13. Add a constant to the binomial so that the resulting trinomial is a perfect square, then factor the trinomial.
$$x^2 + \frac{1}{3}x$$

Question 14. Graph the exponential function.
$$4^x + 1$$

Question 15. Find the power of i.
$$i^{15}$$

Solve the equation.

Question 16.
$$x^2 + 2x - 35 = 0$$

Question 17.
$$\frac{11}{x} = 6 - \frac{1}{x}$$

Question 18.
$$\frac{1}{x+6} + \frac{2}{x+3} = \frac{-3}{x^2 + 9x + 18}$$

Question 19.
$$4^{(3x-5)} = 256$$

Question 20.
$$log_9(x+2) - log_9 x = 2$$

Question 21. Solve the proportion.
$$\frac{4}{y-6} = \frac{5}{y+6}$$

Graph the function.

Question 22.
$$f(x) = -|x+1| - 7$$

Question 23.
$$f(x) = \sqrt{x} - 4$$

Question 24. Rationalize the denominator and simplify.

$$\frac{\sqrt{3} - \sqrt{4}}{\sqrt{3} + \sqrt{4}}$$

Question 25. Write the series with summation notation.

$$14 + 20 + 26 + 32$$

Question 26. Use the quadratic formula to solve the equation.

$$4x^2 + 1 = 3x$$

Question 27. Evaluate the matrix.

$$\begin{vmatrix} 7 & 0 & 0 \\ 6 & 3 & 9 \\ 6 & 2 & 8 \end{vmatrix}$$

Question 28. Write the first five terms of the sequence whose general term is given.

$$a_n = n^2 - n$$

Question 29. Find an equation of the line through $(-2, 4)$, perpendicular to $y = 2x - 2$.

Question 30. Write the function in the form $y = a(x - h)^2 + k$.

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

4

1. $288\pi m^3$

2. $-\dfrac{8}{7}$ **and** $-\dfrac{6}{7}$

3. $15 km/hr$

4. $\dfrac{8}{3}$

5. $97oz$

6. $-1, 1, -6, 6$

7. $\dfrac{3}{4}$
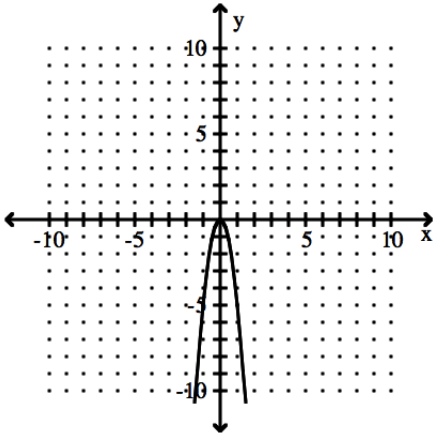
8.
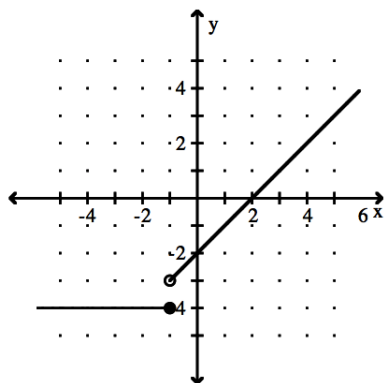
9. $1, -2$

10. $(-1, 2)$

11. $\dfrac{9}{25}$

12.

vertex: (0, 0)

13. $x^2 + \dfrac{1}{3}x + \dfrac{1}{36} = \left(x + \dfrac{1}{6}\right)^2$

14.
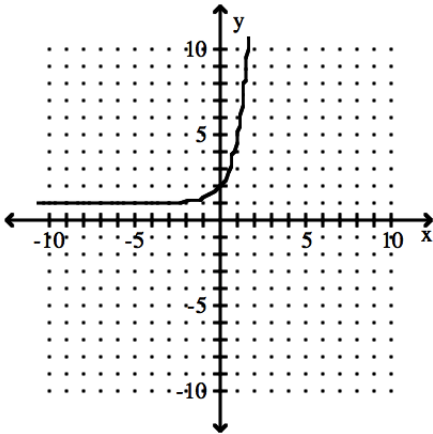
15. $-i$

16. $-7, 5$

17. 2

18. **no solution**

19. 3

20. $\dfrac{1}{40}$

21. 54

22.
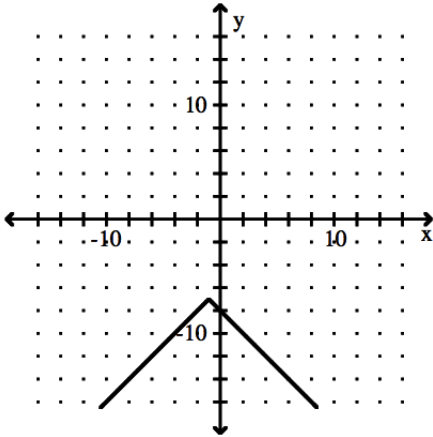
23.
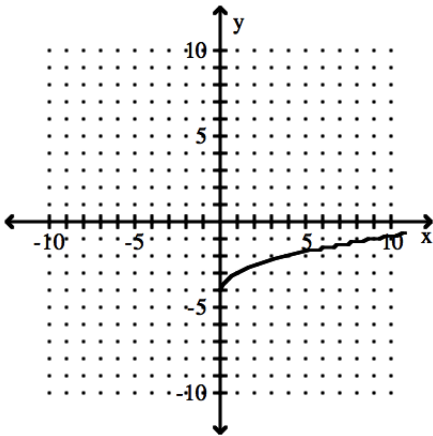
24. $4\sqrt{3} - 7$

25. $\displaystyle\sum_{i=1}^{4}(6i + 8)$

26. $\dfrac{3 - i\sqrt{7}}{8}, \dfrac{3 + i\sqrt{7}}{8}$

27. 42

28. $0, 2, 6, 12, 20$

29. $y = -\dfrac{1}{2}x + 3$

30. $y = -2(x - 1)^2 - 7$

7

Math 96 - Packet B - Free Response

Solve the equation.

Question 1.
$$log_5(x+2) - log_5 x = 2$$

Question 2.
$$x^2 + 9x - 36 = 0$$

Question 3.
$$\frac{1}{x+7} + \frac{4}{x+5} = \frac{-2}{x^2 + 12x + 35}$$

Question 4.
$$27^{3x-5} = 9^{5x}$$

Question 5. Solve the proportion
$$\frac{3}{y+2} = \frac{2}{y-2}$$

Question 6. Solve for x.
$$\sqrt{3x-2} - 2 = 0$$

Question 7. One number is four more than a second number. Two times the first number is twelve more than four times the second number. Find the two numbers.

Question 8. How man real solutions are possible for a system of equations whose graphs are a parabola and a hyperbola?

Question 9. Find the volume of the circular cylinder. Leave your answer in terms of π.
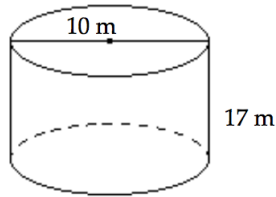
Question 10. Find all solutions for x. Include imaginary numbers if necessary.

$$x^4 - 7x^2 - 144 = 0$$

Question 11. A painter can finish painting a house in 6 hours. Her assistant takes 8 hours to finish the same job. How long would it take for them to complete the job if they were working together?

Question 12. A boat moves 5 kilometers upstream in the same amount of time it moves 18 kilometers downstream. If the rate of the current is 8 kilometers per hour, find the rate of the boat in still water.

Question 13. An arrow is fired into the air with an initial velocity of 160 feet per second. The height in feet of the arrow t seconds after it was shot into the air is given by the function $h(t) = -16t^2 + 160t$. Find the maximum height of the arrow.

Question 14. Evaluate the expression.

$$\sum_{i=2}^{5}(2i - 2)$$

Question 15. Solve the nonlinear system of equations for real solutions.

$$\begin{cases} 4x^2 - 2y^2 = 6 \\ -x^2 + y^2 = 1 \end{cases}$$

Question 16. Write in terms of i.

$$\sqrt{-1600}$$

Graph the function.

Question 17.

$$y = log_2 x$$

Question 18.

$$f(x) = -|x| - 5$$

Question 19. Solve the equation. Give an exact solution.

$$e^{(x+6)} = 3$$

Question 20. Find the value of the logarithmic expression.

$$log_5 \frac{1}{125}$$

Question 21. Find the eighth term of the arithmetic sequence whose first term is -3 and whose common difference is -3.

Question 22. Sketch the graph of the quadratic function. State the vertex and axis of symmetry.

$$f(x) = \frac{1}{5}(x-3)^2 - 1$$

Question 23. Write an equation of the circle with center $(1, 2)$ and radius $\sqrt{5}$.

Question 24. Use the Pythagorean theorem to find the unknown side of the right triangle.
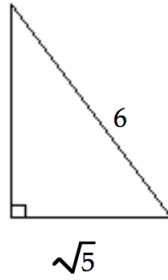
Question 25. Find the power of i.
$$i^{13}$$

Question 26. Solve the equation for x. State the exact solution.
$$ln3x = 4$$

Question 27. Simplify the radical expression. Assume that all variables represent positive real numbers.
$$\sqrt{50k^7q^8}$$

Question 28. Solve the equation for t.
$$P = \frac{A}{1 + rt}$$

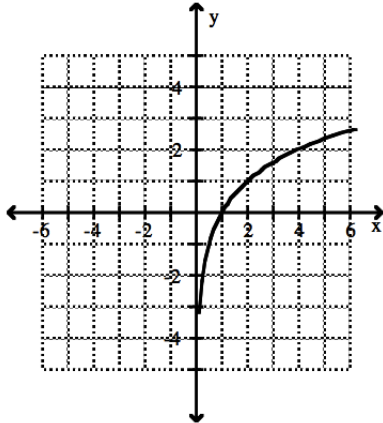**Question 29.** Find the inverse of the one-to-one function.
$$f(x) = \sqrt[3]{x - 7}$$

Question 30. Rationalize the denominator and simplify. Assume that x represents a positive real number.
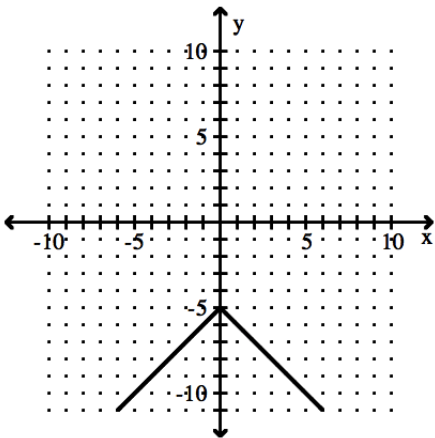$$\frac{5}{\sqrt{x + 6}}$$

Math 96 - Packet B - Answer Key

1. $\dfrac{1}{12}$

2. $-12, 3$

3. **no solution**

4. -15

5. 10

6. 2

7. 2 **and** -2

8. $0, 1, 2, 3,$**or** 4 **real solutions**

9. $425\pi m^3$

10. $-4, 4, -3i, 3i$

11. $3\dfrac{3}{7}$ **hours**

12. $14\dfrac{2}{13}$**km/hr**

13. 400 **ft**

14. 20

15. $(2, \sqrt{5}), (2, -\sqrt{5}), (-2, \sqrt{5}), (-2, -\sqrt{5})$
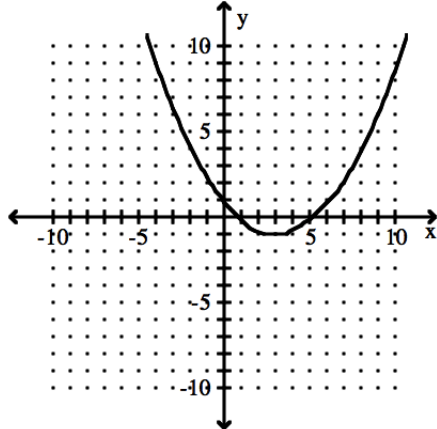
16. $40i$

17.

18.

19. $ln3 - 6$

20. -3

21. -24

22.   vertex $(3, -1)$; **axis** $x = 3$

23. $(x-1)^2 + (y-2)^2 = 5$

24. $\sqrt{31}$

25. i

26. $\dfrac{e^4}{3}$

27. $5k^3 q^4 \sqrt{2k}$

28. $t = \dfrac{A - P}{Pr}$

29. $f^{-1}(x) = x^3 + 7$

30. $\dfrac{5\sqrt{x} - 30}{x - 36}$

Math 96 - Packet C - Free Response

Question 1. Evaluate the matrix.

$$\left[\begin{array}{ccc|c} 1 & 1 & 4 & 2 \\ 0 & 1 & -2 & 6 \\ 0 & 0 & 1 & -3 \end{array}\right]$$

Question 2. Replace R_2 in $\left[\begin{array}{cc|c} -5 & 8 & 1 \\ -3 & 0 & 6 \end{array}\right]$ with $-4R_1 + R_2$.

Question 3. Find the sum of the terms of the infinite geometric sequence.

$$2, -\frac{2}{3}, \frac{2}{9}, \dots$$

Graph the function.

Question 4.

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

Question 5.

$$f(x) = -|x| - 4$$

Question 6.

$$y = log_4 x$$

Question 7. Solve for x.

$$x^2 + 6x + 5 = 0$$

Question 8. A boat moves 7 kilometers upstream in the same amount of time it moves 15 kilometers downstream. If the rate of the current is 9 kilometers per hour, find the rate of the boat in still water.

Question 9. An arrow is fired into the air with an initial velocity of 96 feet per second. The height in feet of the arrow t seconds after it was shot into the air is given by the function $h(t) = -16t^2 + 96t$. Find the maximum height of the arrow.

Question 10. How many real solutions are possible for a system of equations whose graphs are an ellipse and a circle?

Question 11. One number is four more than a second number. Two times the first number is six more than four times the second number.
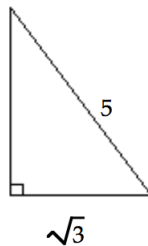
Question 12. Find all solutions for x, including any imaginary numbers as necessary.
$$x^4 - 21x^2 - 100 = 0$$

Question 13. Solve for x.
$$\sqrt{5x - 4} - 4 = 0$$

Question 14. Use the Pythagorean theorem to find the unknown side of the right triangle.

Question 15. Find the distance between the points $(7, -7)$ and $(3, -5)$.

Solve for x.

Question 16.
$$log_5(x+2) - log_5 x = 2$$

Question 17.
$$27^{4x-3} = 9^{2x}$$

Question 18.
$$\frac{1}{x+7} + \frac{3}{x+4} = \frac{-3}{x^2+11x+28}$$

Question 19. Rationalize the denominator and simplify. Assume that x represents a positive real number.
$$\frac{4}{\sqrt{x}+7}$$

Question 20. Use the quadratic formula to solve the equation.
$$2x^2 + 12x = -7$$

Question 21. Find the eighth term of the arithmetic sequence whose first term is 6 and whose common difference is -4.

Question 22. Find the indicated term for the sequence whose general term is given.
$$a_n = \frac{(-1)^n}{n+4}; \quad a_{18}$$

Question 23. Graph the piecewise defined function.
$$f(x) = \begin{cases} -x+4 & \text{if } x < 0 \\ 3x-4 & \text{if } x \geq 0 \end{cases}$$

3

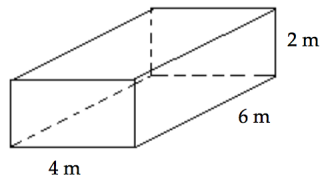**Question 24.** Sketch the graph. State its vertex.

$$x = y^2 + 2$$

Question 25. Write as a logarithmic equation.

$$4^{-2} = \frac{1}{16}$$

Question 26. For the given functions f and g, find the composition.

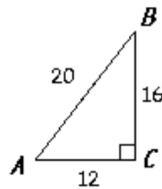$$f(x)x^3 + 2x; \quad g(x) = 3x \quad \text{Find } (g \circ f)(x).$$

Question 27. Find the surface area of the figure.

Question 28. Solve for x. Provide an exact solution.

$$e^{(x+6)} = 3$$

Question 29. Use the given right triangle to find $sinA$

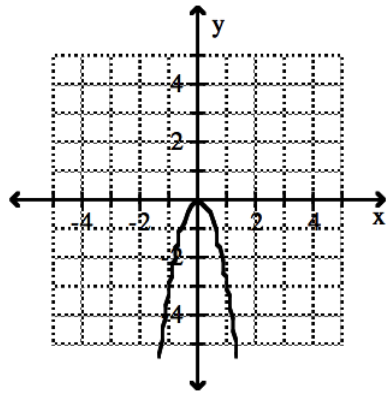**Question 30.** Solve for x. Provide an exact solution.

$$ln11x = -2$$

4

Math 96 - Packet C - Answer Key
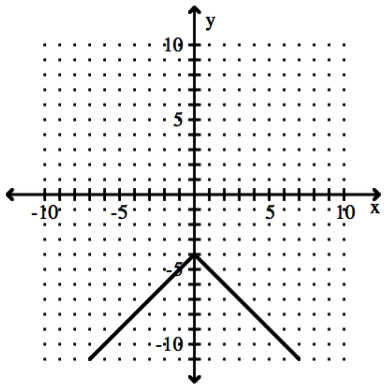
1. $(14, 0, -3)$

2. $\begin{bmatrix} -5 & 8 & | & 1 \\ 17 & -32 & | & 2 \end{bmatrix}$

3. $\dfrac{3}{2}$

4.

5.

6.
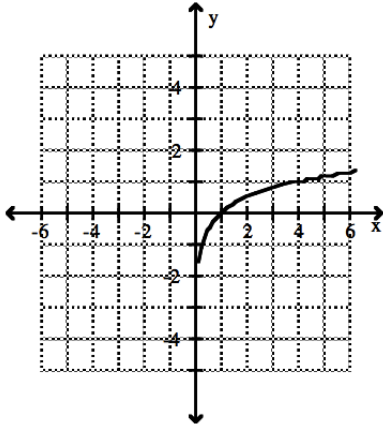
7. $-1, -5$

8. $24\dfrac{3}{4}$**km/hr**

9. 144 **ft**

10. $0, 1, 2, 3,$ **or** 4 **real solutions**

11. 5 **and** 1

12. $-5, 5, -2i, 2i$

13. 4

14. $\sqrt{22}$

15. $2\sqrt{5}$ **units**

16. $\dfrac{1}{12}$

17. $\dfrac{9}{8}$

18.   **no solution**

19. $\dfrac{4\sqrt{x}-28}{x-49}$

20. $\dfrac{-6-\sqrt{22}}{2}, \dfrac{-6+\sqrt{22}}{2}$

21. -22

22. $\dfrac{1}{22}$

23.
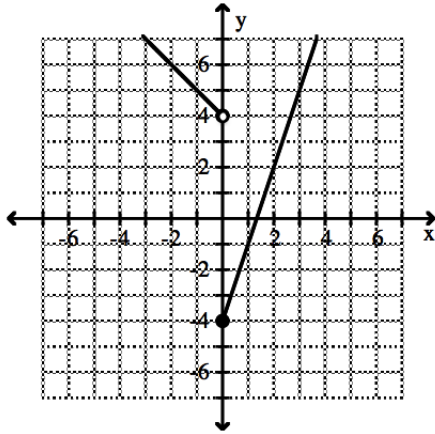
24. **vertex** $(2,0)$
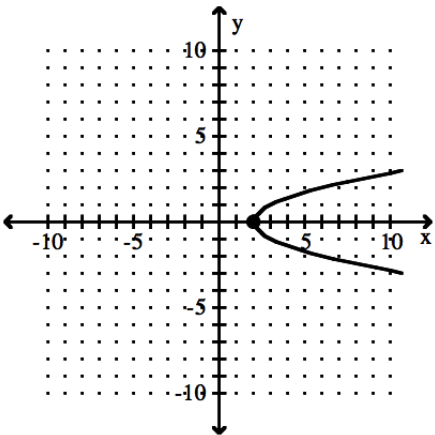
25. $log_4 \dfrac{1}{16} = -2$

26. $3x^3 + 6x$

27. $88m^2$

28. $ln3 - 6$

29. $\dfrac{4}{5}$

30. $\dfrac{e^{-2}}{11}$

1. If $f(x) = -4x$ and $g(x) = x^3 + x^2 - 6$, find each composition of functions:
   a. $(f \circ g)(x)$
   b. $(g \circ f)(x)$

2. Graph the exponential functions and label at least two points on the graph:
   a. $f(x) = 3^x$
   b. $f(x) = \left(\dfrac{1}{2}\right)^x$

3. Graph.
   a. $x = -3(y-1)^2 + 2$
   b. $y = 2(x+1)^2 - 3$

4. Graph.
   a. $\dfrac{(x+3)^2}{25} + \dfrac{(y-2)^2}{36} = 1$
   b. $\dfrac{x^2}{4} - \dfrac{y^2}{9} = 1$
   c. $4y^2 - 25x^2 = 100$
   d. $4y^2 + 25x^2 = 100$

5. Find all real solutions to the following equations:
   a. $x(2x-5) = 3$
   b. $x^2 + 9 = 6x$
   c. $5x^2 + 2x - 1 = 0$

6. Solve the following system of linear equations:
   a.
   $$\begin{cases} x + 2y + 4z = 16 \\ 2y + 2z = -4 \\ y - 3z = 30 \end{cases}$$
   b.
   $$\begin{cases} x + 2y - z = 5 \\ 6x + y + z = 7 \\ 2x + 4y - 2z = 5 \end{cases}$$

7. Find the exact solutions to the following equations:
   a. $3^{2x+1} = 5$
   b. $\log_4(7x-3) = 2$
   c. $4 = \dfrac{25}{1 + 3e^{-\frac{2}{3}x}}$
   d. $\log_6 x - \log_6(4x+7) = 1$

8. Evaluate the following sum:
   a. $\displaystyle\sum_{i=2}^{4}\left(\dfrac{2}{i+3}\right)$
   b. $\displaystyle\sum_{i=2}^{5}\left(\dfrac{3-i}{3+i}\right)$

9. Multiply or divide the following radical expressions and simplify your results completely:
   a. $\sqrt[4]{ab^2} \cdot \sqrt[4]{27ab}$
   b. $\dfrac{\sqrt[5]{64x^{10}y3}}{\sqrt[5]{2x^3y^{-7}}}$

10. Add or subtract the following radical expressions and simplify your results completely:
   a. $\dfrac{\sqrt[3]{3}}{10} + \sqrt[3]{\dfrac{24}{125}}$
   b. $\sqrt{4x^7y^5} + 9x^2\sqrt{x^3y^5} - 5xy\sqrt{x^5y^3}$
   c. $\dfrac{\sqrt[3]{y^5}}{8} + \dfrac{5y\left(\sqrt[3]{y^2}\right)}{4}$