Math 3 Review for Final Exam #1 – Centers of Triangles, Polygons, Quadrilaterals,   Name _____
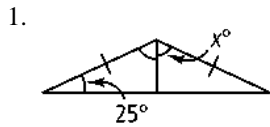
Solve for x.

1.

2.

48
3x

25°

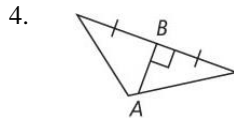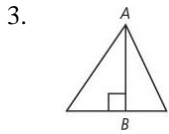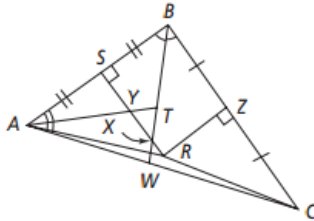**Is $\overline{AB}$ a median, an altitude, or a perpendicular bisector?**

3.   A   4.   B
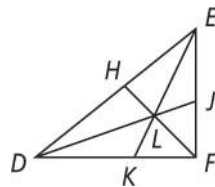
B   A

#5 – 9

5. Which segment is an angle bisector of !ABC?
A. $\overline{RX}$ B. $\overline{AX}$ C. $\overline{AS}$ D. $\overline{BW}$
6. Which segment is a perpendicular bisector of !ABC?
A. $\overline{BW}$ B. $\overline{SB}$ C. $\overline{AS}$ D. $\overline{RZ}$
7. Which point is the circumcenter of !ABC?
A. X B. T C. R D. Y
8. Which point is the incenter of !ABC?
A. X B. T C. R D. Y
9. If RC = x + 3 and RA = 3x - 3, what is the value of x?
A. 3   B. 6   C. 7   D. 9
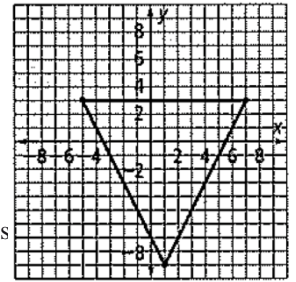
In $\triangle DEF$, L is the centroid.
6. If $HL = 30$, find LF and HF.

7. If $KE = 15$, find KL and LE.

8. If $DL = 24$, find LJ and DJ.
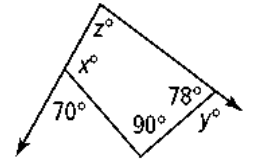
9. $XW = 3a + 5$ and $XV = -2a + 15$.
Find XU.

A. (1, -4)
B. (1, -1.5)
C. (2, 0)
D. (-1, -2)
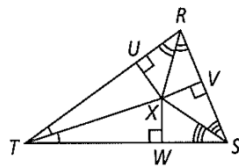
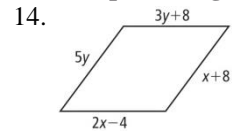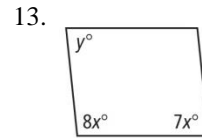11. For an 18-gon, find the angle meas
(a) sum of all interior angles
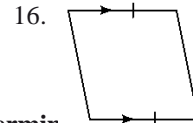(b) one interior angle
(c) one exterior angle

12. Find the missing angle measures.
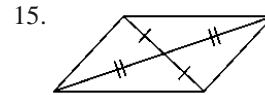
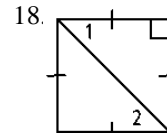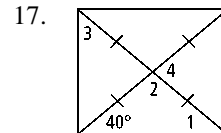$z°$
$x°$
70°   78°
90° $y°$

Find the values of the variables in the parallelogram.
13.   14.   3y+8

$y°$ 5y
                                          x+8
8x°   7x°   2x−4

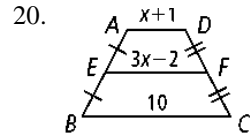**Based on the markings, decide whether each figure must be a parallelogram.**
15.   16.
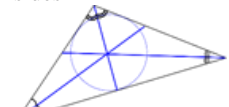
For each parallelogram, determine the most precise name and find the measures of the numbered angles.
17.   18.
3   1
    4
  2
40°   1   2

Find x for the rhombus and trapezoid.
19.   20.   x+1
                                  A   D
(5x−15)°   E   3x−2   F
(4x+1)°   B   10   C
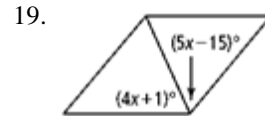
21. Graph the given points. Use slope and the Distance Formula to determine the most precise name for quadrilateral *ABCD*.
$A(-1, 1)$, $B(3, -1)$, $C(-1, -3)$, $D(-5, -1)$

centroid	**incenter**	**circumcenter**
• always falls within the triangle • is located two-thirds of the way along each median or partitions the median into a ratio of 2:1 with the longest segment nearest the vertex • divides the triangle into six triangles of equal area • is the center of gravity for the triangle.	• always falls within the triangle • equidistant from the sides of the triangle • is the center of the circle that is inscribed by the triangle; largest circle that will fit inside a circle and touch all three sides	• falls inside when the triangle is acute; outside when it is obtuse, and on the hypotenuse when it is right. • equidistant from the vertices of the triangle • is the center of the circle that circumscribes the triangle; the circle that passes through all three vertices

1. Which of the following is the cross section created by slicing the cylinder as shown in the figure?

A.   B.   C.   D.
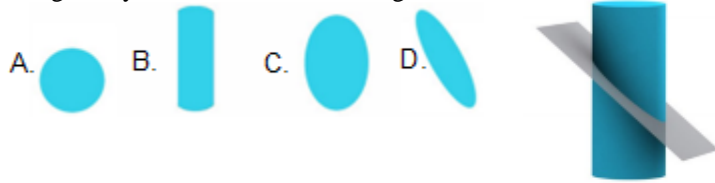
2. What is the cross section formed by a plane that intersects three faces of a cube?
A. triangle   B. square   C. rectangle   D. pentagon

3. The shape at the right was created by rotating a two dimensional shape about an axis. Which of the following would create this shape?

A.   B.

C.   D.

4. Describe each of the following as a simple geometric shape or combination of shapes. Illustrate with a sketch and label dimensions important to describing the shape.
A. Soup can label   B. A bale of hay
C. Paperclip   D. Strawberry

Find the volume of each figure. Round to tenths.

5. $V = Bh$

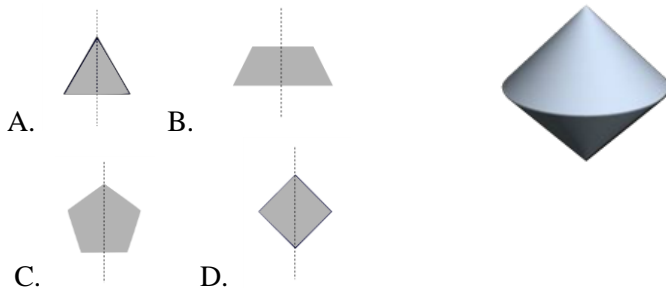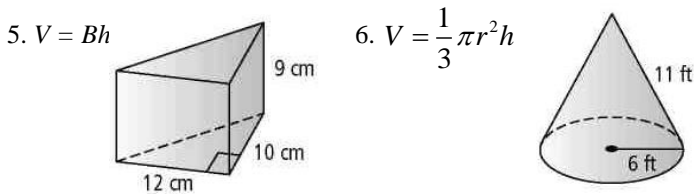9 cm
10 cm
12 cm

6. $V = \dfrac{1}{3}\pi r^2 h$

11 ft
6 ft

Solve each modeling application problem.
7. A cylindrical container with radius 12 cm and height 7 cm is covered in paper. What is the area of the paper? Round to the nearest whole number.
A. 528 cm^2 B. 835 cm^2 C. 1055 cm^2 D. 1432 cm^2

8. A medium-sized box can hold 55 T-shirts. If the dimensions of a jumbo box are three times that of the medium box, how many T-shirts can the jumbo box hold?

9. A carryout container is shown. The bottom base is a 4-inch square and the top base is a 4-inch by 6-inch rectangle. The height of the container is 5 inches. Find the volume of food that it holds.

6 in.
5 in.
4 in.
4 in.
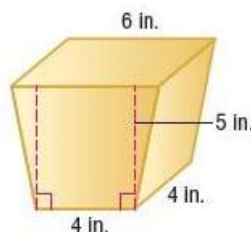
10. A toy manufacture has designed a new piece for use in building models. It is a solid cube with side length 7 mm and it has a 3 m diameter circular hole cut through the middle. The manufacture wants 1000 prototypes. If the plastic used to create the piece costs $270 per cubic meter, how much will the prototypes cost?
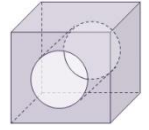
11. The Southern African Large Telescope (SALT) is housed in a cylindrical building with a domed roof in the shape of a hemisphere. The height of the building wall is 17 m and the diameter is 26 m. To program the ventilation system for heat, air conditioning, and dehumidifying, the engineers need the amount of air in the building. What is the volume of air in the building?

12. A King Size waterbed has the following dimensions 72 in. x 84 in. x 9.5in. It takes 240.7 gallons of water to fill it, which would weigh 2071 pounds. What is the weight of a cubic <u>foot</u> of water?

13. Wichita, Kansas has 344,234 people within 165.9 square miles. What is Wichita's population density (people per square mile)?

14. A grain silo has the shape of a right circular cylinder topped by a cone. The approximate area of the circular base is 452.39 ft^2 and the height of the cylinder is 50 ft. The cone adds an additional height of 12 ft. If a bushel of grain is 1.244 ft^3, what is the maximum number of bushels the silo can hold?

15. Janine is planning on creating a water-based centerpiece for each of the 30 tables at her wedding reception.   She has already purchased a vase with a square base for each table.
* The side of the vase's base is 6 cm and the height is 28 cm.
* She intends to fill them half way with water and then add a variety of colored marbles until the waterline is approximately three-quarters of the way up the cylinder.

A.   What is the total volume of the marbles?

B.   If one marble has a diameter of 3 cm., how many marbles must be added to each vase?

C.   If a bag of 20 marbles costs $2, will she be able to purchase enough with her budget of $1000?

Assume that the lines that appear to be tangent are tangent. P **is the center of each circle.** Find the value of x.

1.
.

2.
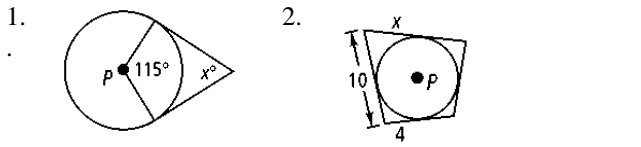
Find the value of each variable.

3.

4.

5.

6.

7.

8.

9.

10.

11.
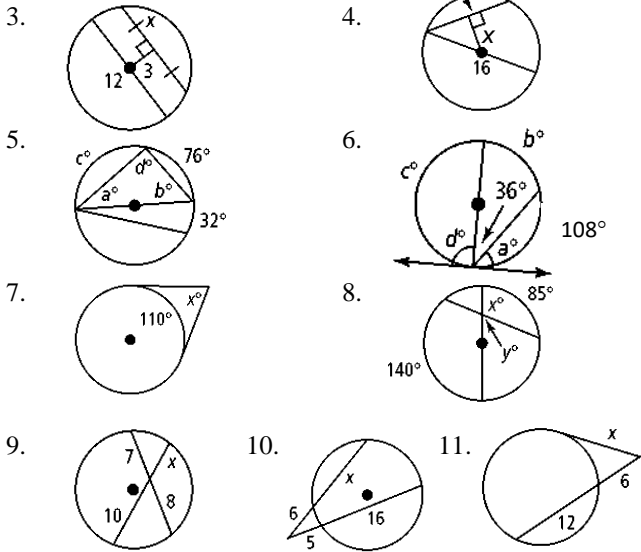
Find the center and radius of each circle. Then graph the circle.

12. $(x+1)^2 + (y+3)^2 = 1$ 13. $x^2 + y^2 - 2x + 4y - 4 = 0$

14. $4x^2 + 4y^2 - 4x + 2y - 1 = 0$

15. Write an equation for a circle given that the endpoints of the diameter are (-2,7) and (4,-8)

Find each measure for the circle: (a) Area of smaller sector (b) length of the shorter arc.   Leave answers in terms of π

16.

17.

18. Determine whether a tangent line is shown.
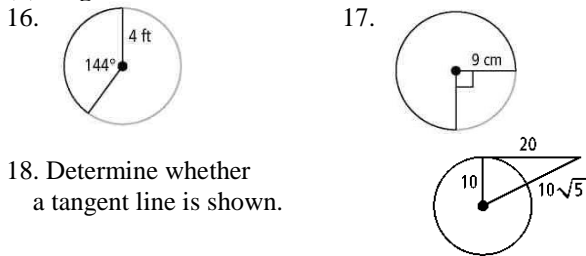
19. How many points with two integer coordinates are 5 units away from (-2, 3)?

20. The length of an arc is 18 cm and the radius of the circle is 6cm. What is the radian measure of the central angle?

21. Write the equation of a circle that is centered at (-1,3) with a radius of 5 units.

22. Explain why there are 2π radians in a circle.

23. Using the whole numbers $1 – 9$ as many times as you like, make the biggest circle by filling in the blanks below:

$$\square x^2 + \square y^2 = \square$$

24. A round table is pushed into a corner. The diameter of the table is 5 feet. Find the distance from the corner to the edge of the table

25.

26.
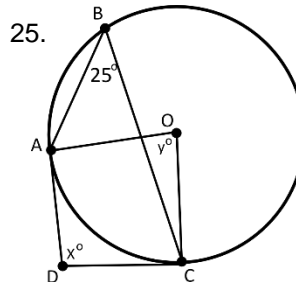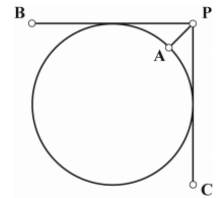
Find the value of x and y.
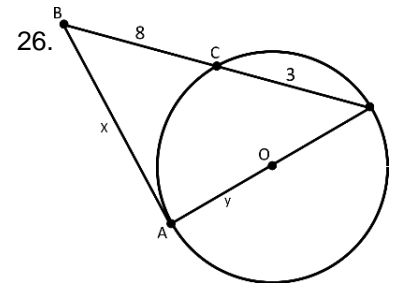
27. The length of an arc is 18 cm and the radius of the circle is 6cm. What is the radian measure of the central angle?

28. Find the area of a sector with an arc length of 40 cm and a radius of 12 cm.

29. Given that $m\angle AOB = \dfrac{2\pi}{3}\ radians$ and the

radius is 18 cm, what is the length of AB ?

Math 3 Review for Final Exam #4 – Special Rt Triangles & Right Triangle Trigonometry   Name _____

In $\triangle RST$, $\angle S$ is a right angle and $\cos R = \frac{12}{13}$. Draw a diagram and find each trigonometric ratio.

1. $\sin R$ 2. $\sin T$ 3. $\cos T$ 4. $\cos R$

Find the value of x. Round lengths of segments and angle measures to the nearest tenth.

5.

37°
12
x

6.

$x°$
25
47

7.

x
48°
5

8.

10
$x°$
6.5
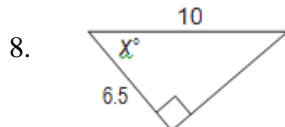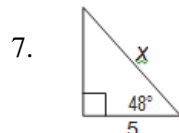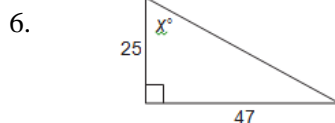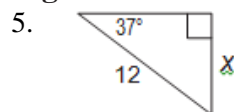
Write each measure in radians.

9. 270°   10. −100°

**Write each measure in degrees.**

11. 5π 12. $-\frac{5\pi}{6}$

(A) **Sketch each angle in standard position.**
(B) **State the quadrant of the terminal side.**
(C) **Find its reference angle.**
(D) **Find one + and one − coterminal angle.**

13. 400°   14. −195°   15. $\frac{3\pi}{4}$ 16. $-\frac{2\pi}{3}$

Sketch the graph of one cycle of each function. State the period, amplitude, shifts, and/or asymptotes.

17. $y = -\sin\left(x - \frac{\pi}{4}\right) + 1$ 18. $y = 2\cos 2x$

Find the exact value of each expression using a unit circle OR sketching the right triangle/reference angle.

19. $\sin 30°$ 20. $\cos \frac{\pi}{4}$

21. $\cos 180°$ 22. $\sin\left(\frac{4\pi}{3}\right)$

Use a unit circle and 30°–60°–90° triangles to find the degree measures of each angle θ for $0 \le \theta \le 2\pi$.

23. angles if $\sin\theta = \frac{\sqrt{3}}{2}$ 24. cosine is $-\frac{1}{2}$

25. A periodic function has a period of 12 s. How many cycles does it go through in 40 s?
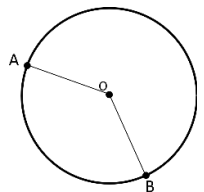
26. An angle in standard position intersects the unit circle at (0, -1). What could be the angle measure?

27. As the angle increases and approaches 90° or $\frac{\pi}{2}$, does the value of the sine or cosine ratio approach 0?

28. An angle with a measure of 4 radians intercepts an arc with a length of 18 ft. What is the length of the radius of the circle?

29. The minute hand on the clock at the City Hall clock in Stratford measures 2.2 meters from the tip to the axle.
a) Through what radian angle measure does the minute hand pass between 7:07 a.m. and 7:43 a.m.?
b) What distance does the tip of the minute hand travel during this period?

30. The following function describes the stock price for Facebook where m stands for the number of months since May 2012. Use technology to graph, make tables.
$$f(m) = -11\sin\left(\frac{2\pi}{4}m\right) + 38$$
a) Interpret the 38 in the context of the problem.
b) What does -11 mean in context of the problem and what is the significance of 11 being negative?
c) How long does it take for the pattern to start repeating?
d) During which months would you want to buy and sell stock in Facebook?

31. A stink bug has crawled into a box fan and sits on the tip of the 1-foot long blade of the fan as seen below. The fan starts to turn slowly due to a breeze in the room.
a) Create a function and a graph that describes its change in height from its original position based on the angle of the blade from its original position.
b) What is the height of the stink bug when the blade has rotated 2 radians? $\frac{11\pi}{6}$ radians?
c) How much has the blade rotated when the stink bugs height is $-\frac{3}{4}$ feet? Can there be more than one answer?

1 ft

Math 3 Review for Final Exam #5 – Function Notation & Graphing, Inverses, Systems   Name _____

1. Given $f(x) = 2x - 11$, find

A. $f(-2)$ B. $f(3 - x)$ C. $f^1(x)$.

Find the inverse of each function. Is the inverse a function?

2. $f(x) = 27x^3 - 1$ 3. $f(x) = \frac{1}{3}x + 3$ 4. $y = 4(x - 1)^2$

Let $f(x) = x^2$ and $g(x) = 3x + 1$. Evaluate each expression.

5. $f^{-1}(x)$ 6. g^{-1}

Describe the transformation of parent function $f(x)$.

7. $g(x) = f(x) + 2$ 8. $h(x) = f(x - 1)$ 9. $h(x) = -3f(x)$

10. Given functions: $f(x) = 4x + 9$ and $g(x) = -2x - 4$
a)   Evaluate $f(-3)$.
b)   Evaluate $g(-3)$.
c)   Add $f(x) + g(x)$.
d)   Evaluate $(f + g)(-3)$.
e)   What do you notice?   What properties have you learned that explain your answer?

11. Which are inverses?

$f(x) = \frac{1}{10}x$ $g(x) = 10^x$ $h(x) = 10x$ $j(x) = \log_{10} x$

Graph each function.

12. $y = 2|x| - 5$ 13. $y = -|x + 4|$

14. $f(x) = \begin{cases} x^2, & x < 0 \\ 2, & 0 \le x \le 3 \\ 4 - x, & x > 3 \end{cases}$ 15. $f(x) = \begin{cases} 3x, for\ x < 0 \\ \frac{1}{x}, for\ 0 \le x < 2 \\ x^3, for\ x \ge 2 \end{cases}$

16. $f(x) = [[x - 4]]$ 17. $y = 4(x - 2)^2$

18. $f(x) = x^2 - 4x + 5$ 19. $y = -(x - 1)(x + 5)$

20. Julia is solving an absolute value inequality in class and has become stuck. Show Julia the next step and write down the explanation for that step so she can reference it on other problems.

Julia's steps:
$2|x + 5| - 3 \le 10$
$2|x + 5| \le 13$
$|x + 5| \le 6.5$

21. Graph the following system and approximate solutions for $f(x) = g(x)$. $f(x) = \frac{x+4}{2-x}$ and $g(x) = x^3 - 6x^2 + 3x + 10$

22. Use technology to solve the equations graphically.
A. $e^{2x} + 3x = 15$ B. $5^{4x} = 2^{8x}$

Solve each system of equations or inequalities.

23. $\begin{cases} y = \ \ x + 4 \\ y = -2x + 3 \end{cases}$ 24. $\begin{cases} 2x - 3y = -6 \\ x + 2y = 11 \end{cases}$

25. $\begin{cases} y \le 2 \\ y > |x - 2| \end{cases}$ 26. $\begin{cases} y = x^2 + 2x - 8 \\ y = \ \ \ \ \ x + 4 \end{cases}$

27. A cell phone company sells its monthly data plans according to the following function, if $f(x)$ represents the total price and x represents the number of gigabytes of data used.
$$f(x) = \begin{cases} 19.95x + 60, for\ 0 \le x \le 3 \\ 9.95x + 75, for\ 3 < x \le 6 \\ 125, for\ x > 6 \end{cases}$$
a)   If a customer uses 3 GB of data, how much will she pay?
b)   How many GB of data are required so a subscriber does not pay any extra money per GB?
c)   If you use 2.5 GB of data per month, what plan will be the cheapest?
d)   How many GB of monthly data will make plan B's price equal to plan C?

28. A cup of coffee is initially at a temperature of 93° F. The difference between its temperature and the room temperature of 68° F decreases by 9% each minute. Write a function describing the temperature of the coffee as a function of time.

Solve each.
29. Chandra bought 2 lbs of cheddar cheese and 3 lbs of chicken loaf. He paid $26.35. Mrs. Hsing paid $18.35 for 1.5 lbs of cheese and 2 lbs of chicken loaf. What was the price per pound of each item?

30. Graph the inverse of $f(x) = -\frac{3}{2}x - 3$. How does $f^{-1}(x)$ relate to $f(x)$?

31. Let $f(x) = x^2 + 7x + 9$. Does an inverse function exist for the entire domain of the function?

32. Consider the table. Write the inverse of the relation. Is it a function?

x	1	2	3	4	5
f(x)	2	4	9	4	12

33. After receiving his business degree from UNC-Chapel Hill, John is offered positions with two companies. Company A offers him $80,000 per year, with a $1,000 increase every year. Company B offers him $60,000 per year with a 4% increase every year. After how many years will the Company B salary be higher than Company A?

1. Write each polynomial in standard form. Then classify it by degree and by number of terms. $3n^2 + n^3 - n - 3 - 3n^3$

2. Determine the end behavior of the graph of each polynomial function. $y = -x^{12} + 6x^6 - 36$

3. Factor $x^3 - 2x^2 - 35x$

4. The expression $(x + 4)$ is a factor of $x^2 + kx - 20$. What is the value of k? How do you know?

5. Factor $x^3 - 8$

6. What are the solutions to the polynomial:
$p(x) = (x - 5)(3x + 5)(x^2 - 7x + 15)$?

7. Write two distinct polynomials, in factored form, with solutions at $1, \frac{4}{3}$, and a double root at -4.

8. Find the zeros of each function. State the multiplicity of multiple zeros.   (a) $y = (x - 3)(x - 4)^2$ (b) $y = x^2(x + 1)^3$

9. Find the real or imaginary solutions of each equation by factoring.
(a) $w^4 + 36 = 13w^2$ (b) $x^3 + 27 = 0$ (c) $t^3 - 3t^2 - 10t = 0$

10. Let $p(x) = x^5 - x^4 + 8x^2 - 9x + 30$. Evaluate $p(-2)$. What does the solution tell you about the factors of $p(x)$?

11. What is the value of a if $(x - 2)$ is a factor of $P(x) = x^4 - 3x^3 + ax^2 - 6x + 14$?

12. Determine the transformation of the cubic parent function $y = x^3$.
(a) $y = 2x^3$ (b) $y = (x+5)^3$ (c) $y = -x^3 + 4$

13. Express $\frac{-x^2 + 4x + 87}{x+1}$ in the form $q(x) + \frac{r(x)}{b(x)}$.

14. How many, and what type (real or imaginary), of solutions exist for the functions? Are any multiplicities of 2?
(a) $f(x) = x^4 - 10x^2 - 21x - 12$

(b) $f(x) = x^5 - 3x^4 - 27x^3 + 19x^2 + 114x - 72$?

15. Divide (distribute, long or synthetic).
(a) $\frac{6x^3 + 15x^2 + 12x}{3x}$

(b) $(x^3 + 11x + 12) \div (x - 2)$

(c) $\frac{x^3 - 3x^2 + x - 6}{x^2 + 2}$

16. Find the relative maximum and minimum of the graph of $f(x) = x^3 - 3x^2 + 2$.

17. Find the roots/zeros of each polynomial (real/ imaginary).
(a) $x^3 + 2x^2 + 3x + 6 = 0$ (b) $g(x) = 3x^3 - 3x^2 + x - 1$

18. Build polynomial functions with a double root at -2 and another root at 5.

19. The expression, $.0013x^3 - .0845x^2 + 1.6083x + 12.5$, represents the gas consumption by the United States in billions of gallons, where x is the years since 1960. Based on the expression, how many gallons of gas were consumed in 1960? How do you know?

20. Clara works for a marketing company and is designing packing for a new product. The product can come in various sizes. Clara has determined that the size of the packaging can be found using the function, $p(b) = (b)(2b + 1)(b + 5)$, where b is the shortest measurement of the product. After some research, Clara determined that packaging with $20,500 \ cm^3$ will be the most appealing to customers. What are the dimensions of the package?

21. For the function, label and describe the key features: intercepts, relative max/min, intervals of increase/decrease, and end behavior.
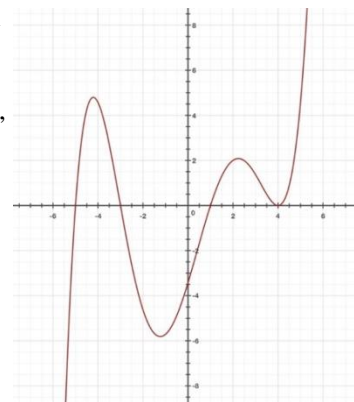
Math 3 Review for Final Exam #7- Exponent, Logarithmic, & Rational Functions   Name _____

Graph each equation. State the domain and range plus any vertical or horizontal asymptote, x or y-intercepts.

1. $y = 3^x - 1$

2. $y = \left(\dfrac{1}{4}\right)^x$

3. $y = 2\log x$

4. $y = \log_4(x+1)$

Determine whether each equation represents exponential growth or exponential decay. State the initial amount and percent of growth/decay.

5. $y = 0.5(1.67)^x$

6. $y = 1.023(0.98)^x$

7. $y = 35e^{-4x}$

8. $y = 400e^{3.2x}$

Write each equation in logarithmic form.

Write each equation in exponential form.

9. $9^3 = 729$

10. $e^{-x} = \dfrac{1}{2}$

11. $\log n = 3$

12. $\ln 1 = 0$

Evaluate each logarithm without a calculator.

13. $\log 1000$

14. $\log_4 \dfrac{1}{16}$

15. $5\ln 1$

16. $\log_{25} 5$

17. $\log_{27} 9$

18. $\log_8 \dfrac{1}{2}$

19. $\dfrac{1}{\ln e^{20}}$

20. Which of the following equations have an inverse function? How do you know, from the table and graph? For any that do not, how can we limit the domain of the function to ensure that it has an inverse?   A. $f(x) = 2x$ B. $f(x) = x^2$ C. $f(x) = 2^x$

Solve each equation.

21. $7^{\frac{x}{4}} = 5$

22. $2 - 4^x = -62$

23. $\log_3(x+1) = 4$

24. $e^{3x} = 20$

25. $36^{x+1} = 6$

26. $\log x = -2$

27. $\log_9(x+1) = \log_9(2x-11)$

28. $\ln(x+2) = \ln(4x)$

29. Sketch the asymptotes and the graph of each function. Identify the domain and the range. (a) $y = \dfrac{8}{x} - 1$ (b) $y = \dfrac{1}{x-2} + 1$

30 Write an equation for the translation of $y = \dfrac{4}{x}$ that has the given asymptotes. $x = -2$ and $y = -4$

31. Find vertical and horizontal asymptotes, the domain, and x- and y-intercepts of each rational function. Sketch graph.

(a) $y = \dfrac{-3x}{x^2 - 4}$

(b) $y = \dfrac{3x^2 + 2x}{x}$

(c) $y = \dfrac{x^2 - 16}{x^2 + 4}$

Simplify. State any restrictions on the variables (what values make the denominator = 0?).

32. $\dfrac{5x^2 y}{10xy^4}$

33. $\dfrac{4d^2 + 8d}{2d}$

34. $\dfrac{x^2 + 9x + 18}{x+6}$

35. $\dfrac{x^2 + 3x + 2}{x-1} \cdot \dfrac{x-1}{x+2}$

368. $\left(\dfrac{2x+4}{x^2-6x}\right)\left(\dfrac{x^2-36}{4x+8}\right)$

37. $\dfrac{x^2 - 2x - 8}{x+3} \div \dfrac{x-4}{x+3}$

38. $\left(\dfrac{x^2-4}{x^2+2x-5}\right) \div \left(\dfrac{x+2}{x^2+2x-5}\right)$

39. $\dfrac{\frac{1}{x} + \frac{3}{2}}{\frac{3x+2}{2x}}$

40. $\dfrac{4x+13}{x-3} + \dfrac{x+2}{2x+6}$

41. $\dfrac{3x+7}{x-2} - \dfrac{3x+15}{2x-4}$

42. $\dfrac{2}{x-1} - \dfrac{3}{1-x}$

43. Why does multiplying a numerator and denominator by 2 NOT double the value of a rational expression?

Solve each equation. Check each solution.

44. $\dfrac{2}{x^2 - 1} = \dfrac{4}{x+1}$

45. $\dfrac{3}{x+4} + \dfrac{5}{4} = \dfrac{18}{x+4}$

46. Explain why the following expressions are equivalent. $2\left(\dfrac{1}{2}\right)^6$ $\left(\dfrac{1}{2}\right)^5$ $2\left(\dfrac{1}{4}\right)^3$

1. Find the mean and standard deviation for the data set.   12 9 10 11 13 9 20

2. Determine what type of study would establish a cause-effect relationship for each situation: an observation, a simulation, an experiment, a survey. (a) cell-phone use and brain tumors   (b) fertilizer use and plant growth

3. A recent poll suggests that 41% of American citizens are going to vote for the Democratic candidate for president, with a margin of error of ±3.5%. Set up and solve an absolute value inequality to determine the range of possible percentages the candidate could earn. Based on your answer, can you determine if the Democratic candidate will win the election? Why or why not?

4. From a class containing 10 girls and 18 boys, four students are to be selected to serve on a school advisory panel. Here are four different methods of making the selection.
a)   Select the first 4 names on the class roll.
b)   Select the first 4 students who volunteer.
c)   Place the names of the 28 students in a hat, mix them thoroughly, and select three names from the mix.
d)   Select the last 4 students who show up for class tomorrow.
Which is the best sampling method, among these four, if you want the school panel to represent a fair and representative view of the opinions of your class?

5.The Gap manager wants to know which of two advertisements is more effective in increasing sales among people who have a credit card with the store. A sample of 200 people will be selected from the 6,500 people who have a credit card with the store. Each person in the sample will be called and read one of the two advertisements. It will then be determined if the credit card holder makes a purchase at the Gap within two weeks of receiving the call.
a)   Describe the method you would use to determine which credit card holders should be included in the sample. Provide enough detail so that someone else would be able to carry out your method.

b)   For each person in the sample, the Gap will flip a coin. If it lands heads up, advertisement A will be read. If it lands tails up, advertisement B will be read. Why would the manager use this method to decide which advertisement is read to each person?

6. A student wants to determine the difference if other students can identify whether a drink is Coke or Pepsi. Which type of study would be the most practical to obtain this information?
A. simulation   B. experiment   C. survey   D. observation

7. A student claims that there are twice as many brown M&M's in a fun—size bag
 as green. The graph displays the number of M&M's found in 10fun-size samples.
 A. Use the data from the 10 sample to estimate the average proportions of M&M's in
a fun-size bag.

B. Find the margin of error for the samples.

C. Estimate the average range of brown and green in a fun-size.

D. If a fun-size bag contained 10 M&M's, how many browns and greens could you expect?
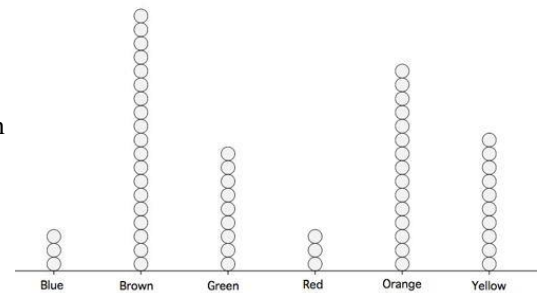
8. "We were pleased to get an effect after five days," says Patricia Greenfield, a senior author of the study and a distinguished professor of psychology at UCLA. "We found that the kids who had been to camp without any screens but with lots of those opportunities and necessities for interacting with other people in person improved significantly more."

If the study were to be expanded, Greenfield says, she'd like to test the students at camp a third time — when they've been back at home with smartphones and tablets in their hands for five days.

"It might mean they would lose those skills if they weren't maintaining continual face-to-face interaction," she says.
    a.   What is the source of the data?
    b.   Describe the design of the study.
After analyzing the graph, evaluate the claim that the
"kids who had been to camp … improved significantly more."
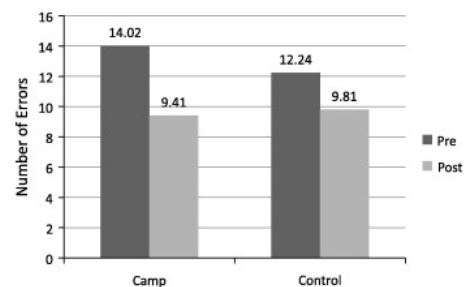
Math 3 Review for Final Exam #9-10: Function Applications and Modeling   Name _____

1. Tonya wants to make a metal tray by cutting four identical square corner pieces from a rectangular metal sheet. Then she will bend the sides up to make an open tray.

a. Express the volume of the box as a polynomial function of x if the length of each side of the removed squares be x in..

b. Find the dimensions of a tray that would have a 384-in.³ capacity.
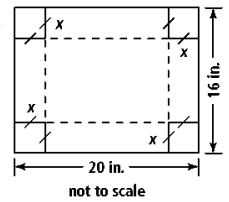
2. The table shows the annual population of Florida for selected years.

a. Find a polynomial function that best models the data.
b. Use your model to estimate the population of Florida in 2020.
c. Use your model to estimate when the population of Florida will reach 20.59 million.

| Year	1970	1980	1990	2000
Population (millions)	6.79	9.75	12.94	15.98

3. Which of the following functions have inverse functions? For those that are do not have inverse functions as a whole, divide the graph into sections that do have inverse functions.
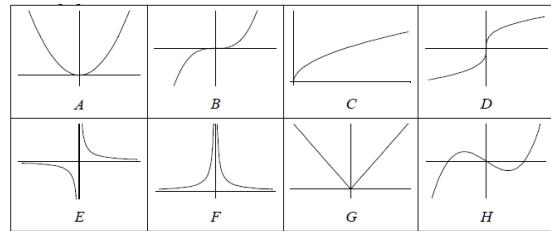
4. Use a table of $f(x) = 3x^2 - 18x + 5$ to determine possible domains on which $f^{-1}(x)$ is a function.

5. If $f(x) = -(x + 7)^2(x - 2)$ and $g(x)$ is represented on the graph.

a) What is the difference between the zero with the least value of $f(x)$ and the zero with the least value of $g(x)$?
b) Which has the largest relative maximum?
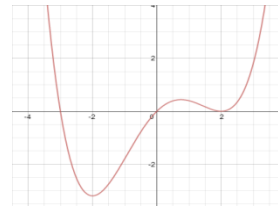
c) Describe their end behaviors. Why are they different? What can be said about each function?

6. What is the lowest possible degree of the function graphed below? How do you know? What is another possible degree for the function?

7. Build a polynomial function that could represent the following graph, and explain how each characteristic you could see on the graph helped you build the function.
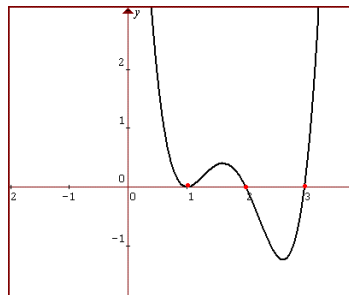
8. The graph of $f(x)$ and the equation of $g(x)$ are shown below. Which has a higher y-intercept? Explain your answer.
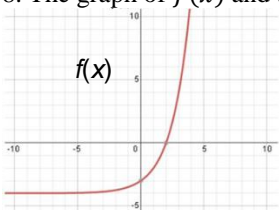
f(x) $g(x) = 2^x - 7$

9. A manufacturer bought a new rolling press for \$48,000. It has depreciated in value at an annual rate of 15%. What is its value 5 years after purchase? Round to the nearest hundred dollars.

10. You place \$900 in an investment account that earns 6% interest compounded continuously. Find the balance after 5 years.

11. The monthly cost $C(p)$ of removing p percent of pollutants from waste byproduct in manufacturing can be modeled by the function $C(p) = \dfrac{1500p}{100 - p}$. A manufacturer decides to spend \$28,500 per month for removal of pollutants. What percent of the pollutant can the manufacturer expect to remove from the waste?

12. In a Math 3 class, the red group has four members. Brian can solve a rational equation in 5 minutes, Luis can solve one in 4 minutes, Sylvia can solve one in 6 minutes, and Tierra can solve one in 3 minutes. Set up and solve a rational equation to determine how long will it take the group to complete a 10 problem worksheet if they work together. Is this answer accurate, based on the context? Why or why not?

13. Graph $g(x) = x^3 + 5x^2 + 2x - 8$.
a) Identify zeroes.
b) Discuss the end behavior.
c) In what intervals is the function increasing? Decreasing?

14. Graph $y = 3\sin(x) - 5$ and answer the following questions:
a) What is the period?
b) For the domain of $-2\pi < x < 2\pi$, identify any relative maxima and minima, intervals of increasing and decreasing, and lines of symmetry.

15. For $(x) = \dfrac{x+4}{2-x}$, discuss end behavior and any discontinuities.

16. Given the following piecewise function $h(x) = \begin{cases} x^2, & -3 \le x < 3 \\ 2 - x, & 3 \le x < 7 \end{cases}$ discuss the key features, including domain and range, intercepts, relative maximum and minimums, end behavior and discontinuities.

17. Use the table below to identify the transformations and write the equation of the absolute value function f(x).

x	-6	-5	-4	-3	-2
f(x)	3	1	-1	1	3

18. Why does $g(x) = \dfrac{1}{x-3}$ shift to the right three units from the rational function $f(x) = \dfrac{1}{x}$?

19. Two objects dropped downward at the same time from a top of building. For both functions, t represents seconds and the height is represented in feet. The function's data of the first object is given by this table:

t	$s(t)$
0	20
2.5	15
3.5	10
4.3	5
5	0

20. The function's graph of the second object is shown at the right:
a) Which object was dropped from a greater height? Explain your answer.
b) Which object hit the ground first? Explain your answer.
c) Which object fell at a faster rate (in ft/sec)? Explain your answer.

21. If the world population at the beginning of 2008 was 6.7 billion and growing at a rate of 1.16% each year, in what year will the population be double?

22. Over a year, the length of the day (the number of hours from sunrise to sunset) changes every day. The table below shows the length of day every 30 days from 12/31/97 to 3/26/99 for Boston Massachusetts.

Data on length of day

Date	12/31	1/30	3/1	3/31	4/30	5/30	6/29	7/29	8/28	9/27	10/27	11/26	12/26	1/25	2/24	3/26
Day Number	0	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450
Length (hours)	9.1	9.9	11.2	12.7	14.0	15.0	15.3	14.6	13.3	11.9	10.6	9.5	9.1	9.7	11.0	12.4

During what part of the year do the days get longer? Support your claim using information provided from the table.

23. For the following function: $h(x) = \begin{cases} 2^x, & x < -3 \\ \frac{3}{x}, & x \geq -3 \end{cases}$

a)   Evaluate $h(-4)$.
b)   Evaluate $3\,h(0) + 2\,h(-3) - h(-6)$.
c)   What is the domain of $h(x)$? Explain your answer.

24. The Charlotte Shipping Company is needing to create an advertisement flyer for its new pricing for medium boxes shipped within Mecklenburg County. Based on the expressions of the function below, where c represents cost and p represent pounds, create an advertisement that discusses all important details for the public. $c(p) = \begin{cases} 11.45, & p \leq 12\frac{1}{3} \\ .72\,p + 5.57, & p > 12\frac{1}{3} \end{cases}$

25. A company is manufacturing an open-top rectangular box. They have 30 cm by16 cm sheets of material. The bins are made by cutting squares the same size from each corner of a sheet, bending up the sides, and sealing the corners. Create an equation relating the volume V of the box to the length of the corner cut out x. Graph the equation and identify the dimensions of the box that will have the maximum volume. Explain.

30 cm

16 cm
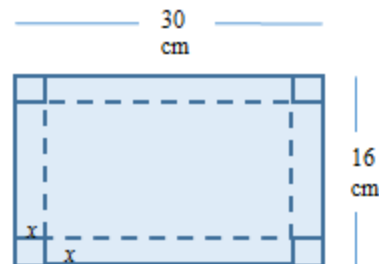
26. A caterer must make at least 50 gal of potato soup and at least 120 gal of tomato soup. One chef can make 5 gal of potato soup and 6 gal of tomato soup in 1 h. Another chef can make 4 gal of potato soup and 12 gal of tomato soup in 1 h. The first chef earns $20/h. The second chef earns $22/h. How many hours should the company ask each chef to work to minimize the cost?

27. Using technology, determine the average rate of change of the following functions for intervals of their domains in the table.

Functions	Average rate of change $0 \leq x \leq 10$	Average rate of change $10 \leq x \leq 20$	Average rate of change $20 \leq x \leq 30$	Average rate of change $30 \leq x \leq 40$	Average rate of change $40 \leq x \leq 50$
$f(x) = x^3$					
$f(x) = 1.3^x$					

a) When does the average rate of change of the exponential function exceed the average rate of change of the polynomial function?
b) Using a graphing technology, graph both of the functions. How do the average rates of change in your table relate to what you see on the graph?