Alg 2 CC *Midterm Review*

Name_____

1. Factor completely over the reals.

a.) $x^3 + 25x$

b.) $12r^8 - 75r^4$

c.) $3x^2 + 3x - 60$

d.) $2x^3 - 128$

2. What is the **product** of $a + bi$ and its conjugate?

(1) $a + b$ (2) $a^2 + b^2$ (3) $2a + 2b$ (4) 0

3. Brian correctly used a method of completing the square to solve the equation $x^2 + 7x - 11 = 0$. Brian's first step was to rewrite the equation as $x^2 + 7x = 11$. He then added a number to both sides of the equation. Which number did he add?

(1) $\frac{7}{2}$ (2) $\frac{49}{4}$ (3) $\frac{49}{2}$ (4) 49

4. Determine whether a and b are greater than zero, less than zero, or equal to zero for the given complex number $a+bi$.

a. $a+bi$ lies in the second quadrant of the complex plane

b. $a+bi$ lies in the negative imaginary axis of the complex plane

5. Verify the identity: $(3x + y)^2 - (2y)^2 = 3(x + y)(3x - y)$

6. Solve **algebraically** for all value(s) of *x*: $2(x - 3)^2 + 6 = 14$

7. Simplify and leave answer in standard form: $i^{22} + 3i^{40} - 2i^{37}$

8. Solve the system of equations **algebraically**: $x^2 + y^2 = 225$
$x - 7y = -75$

9. Given the function $f(x) = \frac{x^2-x}{x^3+x}$, circle the choice that best describes the symmetry of the function.

a. even b. odd c. neither even nor odd d. both even and odd

10. Which of the following is the remainder when $4x^3 - 8x^2 + 5x$ is divided by $2x - 3$?

a. 3 b. 2 c. 1.5 d. 1

11. Solve **algebraically** for *b*: $(4^{-1} \cdot 8^3)^{-2} = 2^b$

12. Solve **algebraically** for *x*: $\frac{2-x}{x-2} = \frac{2-2x}{x-5}$

13. Find *x* and *y*: $\sqrt[3]{\sqrt{3}} = x^y$

14. Solve **algebraically** for *x* and *y*: $-2x + 5yi = 2(3 - 7i)$

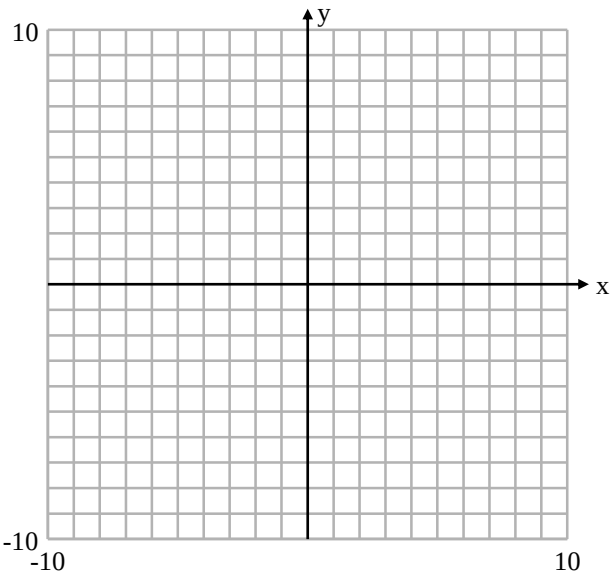
15. Solve **algebraically** for all values of *x* over the set of complex numbers: $x^4 - 2x^2 - 3 = 0$

16. For what value of *k* will $(x - 1)$ be a factor of $4x^3 + kx^2 - 7x - 10$?

17. Simplify each of these completely:

$\sqrt[3]{-81x^2y^5z^{11}}$ $\sqrt[4]{256x^7y^4z^{11}}$

18. Graph $y = 2(x-1)^2 - 4$



Vertex:_____

Axis of Symmetry:_____

x-intercept(s):_____

y-intercept:_____

Over what interval of the domain is the graph:

Increasing _____

Decreasing _____

Over what intervals of the domain is:

$y > 0$ _____

$y < 0$ _____

Find the average rate of change over the interval [-2,2].

19.) Simplify: $\dfrac{2x - x^2}{x^2 - 5x + 6}$

20.) Solve **algebraically** for *x*, leave answer in simplest $a + bi$ form: $x^2 - 6x + 10 = 0$

21.) Find the quadratic equation given one root is $-2+3i$.

22.) Solve **algebraically** for *x*: $\frac{x}{x-4}-\frac{1}{x+3}=\frac{28}{x^2-x-12}$

23.) A cell phone tower transmits in the range of the circle $x^2-2x+y^2-2y=2$. A person in a car traveling along a straight road $x+y=4$ will have cell phone reception between what two geographic coordinates? Only an *algebraic solution* will be accepted.

24.) Describe the transformation from the parent function $y=2^x$ to the function $y=-(2)^{x-3}+7$.

25.) Describe the complete transformation from $y=3^x$ to the function $y=-2(3)^{x-2}+4$.

26.) **Algebraically**, find $f^{-1}(x)$ of the function: $f(x) = 2x - 3$

27.) Find the value of the discriminant and describe the nature of the roots $2x^2 + 7x + 2 = 0$

28.) Simplify: $\dfrac{x^{\frac{1}{2}}}{x^{\frac{2}{3}}}$

29.) Simplify: $\sqrt[5]{-64a^5b^9c^{13}}$

30.) Growth of a certain strain of bacteria is modeled by the equation: $G = A(2.7)^{0.584t}$, where G = final number of bacteria, A = initial number of bacteria, t = time in hours. In how many hours, will 4 bacteria increase to 2500 bacteria? Only an **algebraic solution** will be accepted. Round to *nearest hundredth*.

31.) Solve **algebraically** for all values of x: $2x^3 - 14x^2 + 3x - 21 = 0$

32.) Describe the nature of the roots: $x^2 - 6x - 16 = 0$

(Hint: Real or imaginary? If real… Equal or unequal? Rational or irrational?)

33.) You have $1600 to deposit in a bank account. You are going to leave your money in this account for 3 years. Which of the following interest deals do you choose?

a. The account pays 2.5% annual interest compounded monthly.

b. The account pays 1.75% annual interest compounded continuously.

34.) Find $f^{-1}(x)$ given $f(x) = x^3 + 2$.

35.) Write the expression in simplest form: $y\sqrt[3]{24x^5} + x\sqrt[3]{3x^2y^3}$.

36.) Solve for x: $\sqrt{2x-3} = \frac{1}{2}x$

(a) 2 (b) 2, 6 (c) $\frac{18}{7}$ (d) $\frac{21}{4}$ (e) none of these

37.) Simplify: $\frac{x^3 + 27}{x^2 + 7x + 12} \bullet \frac{x^2 - 9}{x^2 - 3x + 9}$

38.) Simplify: $\frac{5x^2}{y^{-2}} \div 25x^2y$

39.) If point (a, b) lies on the graph $f(x)$, then the graph $f^{-1}(x)$ must contain point:

(a) (b, a) (b) (a, 0) (c) (0, b) (d) (– a, – b)

40.) Solve **algebraically** for *x*: $2\sqrt{8x+1} = 4 + 2x$

41.) Factor completely:

a. $x^3y - 6x^2y - 16xy$

b. $4x^2 - 100y^4$

c. $3x^2 - 12x - 15$

d. $2x^3 - 250y^6$

42.) Simplify: $3i^4 \cdot i^{10} \cdot 5i^{12}$

43.) Simplify: $2x + i^7 + xi^{16}$

44.) The equation for the depreciation of a vehicle purchased in 1999 is modeled by the equation:

$$y = 11{,}900(0.87)^t$$

a. What is the rate of depreciation for this vehicle?

b. How much is the vehicle worth in 2002, if the rate of depreciation stays constant?

45.) The given equation represents the path of a rock thrown vertically from the ground: $h(t) = 2 + 24t - 4.9t^2$

[Round all answers to the *nearest hundredth*]

a. How many seconds will it take the rock to reach maximum height?

b. How many seconds will it take the rock to hit the ground?

c. What is the height of the rock after 2.7 seconds?

46.) You deposit $2000 in a savings account in 2000. It appreciates 12% each year. During which year, will the savings account be worth $4500?

47.) Solve **algebraically** for *x*: $\frac{3}{x-3} + \frac{x}{3-x} = x$.

48.) If Tommy invests $4000 into a savings account in 2004, in *what year* will his investment be worth $6500 if he earns 2.7% interest compounded continuously?

49.) Solve **algebraically** for *x*: $(x-t)^2 - 3x(x-t) = -2x^2$

50.) Write the equation of a parabola whose directrix is $x = 10$ and focus is $(5,2)$.

51.) Write the quadratic equation when given the roots: $r_1 = 1 - \sqrt{7}$, $r_2 = 1 + \sqrt{7}$

For #52-54, Express in terms of i, and simplify into standard form:

52.) $-\sqrt{-192}-\sqrt{-147}$

53.) $-4\sqrt{-6}\bullet\frac{1}{2}\sqrt{-8}$

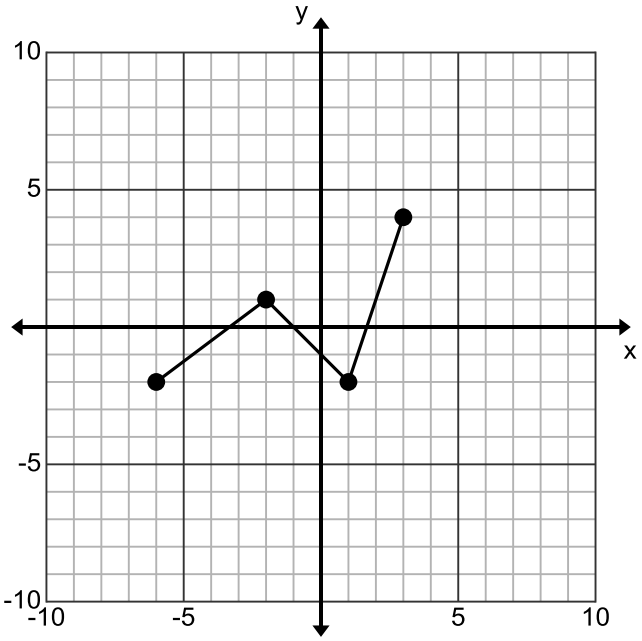
54.) $(2-i)^2+i$

55.) For what value(s) of k are the roots of $2x^2-8x+k=0$ equal?

56.) Solve **algebraically** for x: $\left(\frac{1}{4}\right)^{3x-1}=8^{x-4}$

57.) A company is designing their logo from the curves $x^2+y^2=169$ and $y=\frac{1}{8}x^2-13$. What are the intersection points on this logo? Only an algebraic solution will be accepted.

58.) Given the function on the graph, sketch the following transformations on the axes provided. Use different colors to differentiate each transformation.



a. $2f(x)$

b. $f(x-2)$

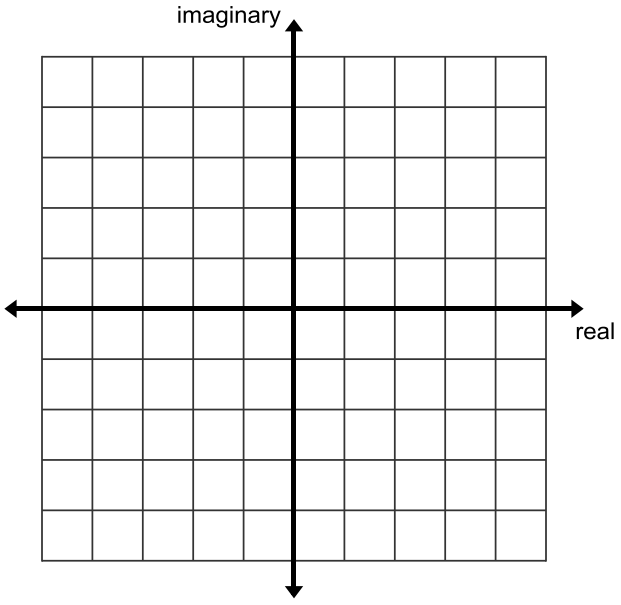
c. $-f(x)$

59.) Write the following using radical notation: $3x^{\frac{2}{3}}$

(a) $3\sqrt[3]{x^2}$ (b) $\sqrt[3]{3x^2}$ (c) $\sqrt[2]{3x^7}$ (d) $3\sqrt[2]{x^3}$

60.) a. Graph the sum of $(3-2i)$ and $(-4+5i)$.

b. In what quadrant is the sum located?



61.) Factor **completely**: $27x^3y^2 - 8y^2$

62.) Solve for *x*, **algebraically**: $3x^3 - 15x^2 + 2x - 10 = 0$

63.) Solve **algebraically** for the **exact value** of *x*: $\left(\frac{1}{27}\right)^{3x-1} = 9^{2x+7}$

64.) Describe the transformation of $y = \sqrt{x-3} + 2$ from its parent function $y = \sqrt{x}$.

65.) Solve **algebraically** for *x*: $\sqrt{2x + 10} - 2\sqrt{x} = 0$

66.) Find all the **real** roots of the equation: $y = 2x^3 + 11x^2 + 4x - 5$

67.) Simplify completely: $\dfrac{36xy^{-2}z}{24x^3yz^{-2}}$

68.) Solve **algebraically** for x: $3(x+1)^{4/3} = 48$

69.) Solve **algebraically** for all value(s) of x: $\sqrt{3x+7} + 1 = x$

70.) Which expression is equivalent to $\left(\dfrac{16x^{\frac{1}{6}}y^{-2}}{x^{\frac{-1}{6}}y^{6}}\right)^{\frac{3}{2}}$?

(a) $24x^{\frac{9}{2}}y^{\frac{9}{2}}$ (b) $\dfrac{24x^{\frac{3}{4}}}{y^{9}}$ (c) $\dfrac{64}{x^{\frac{1}{2}}y^{8}}$ (d) $\dfrac{64x^{\frac{1}{2}}}{y^{12}}$

71.) Consider the equation: $\frac{4^{x^2}}{2^x} = 2$

Part A: Which equation is equivalent to the equation shown?

(a) $2^{x^2} = 2$ (b) $2^{x^2-x} = 2$ (c) $2^{2x} = 2$ (d) $2^{2x^2-x} = 2$

Part B: Which values are solutions to the equation? Circle **all** that apply.

(a) -2 (b) -1 (c) $-\frac{1}{2}$ (d) $\frac{1}{2}$ (e) 1 (f) 2

72.) If $\sqrt{\sqrt[3]{(x+1)^5}} = (x+1)^a$, for $x \geq -1$, and a is a constant, what is the value of a ?

(a) $\frac{3}{10}$ (b) $\frac{5}{6}$ (c) $\frac{5}{3}$ (d) $\frac{10}{3}$

73.) Solve **algebraically** for x: $\frac{1}{16} = 2^{3x-1}$

74.) Which expression is equivalent to $\left(5^{-2}a^3b^{-4}\right)^{-1}$?

(a) $\frac{10b^4}{a^3}$ (b) $\frac{25b^4}{a^3}$ (c) $\frac{a^3}{25b^4}$ (d) $\frac{a^2}{125b^5}$

75.) What is the product of $\sqrt[3]{4a^2b^4}$ and $\sqrt[3]{16a^3b^2}$?

(a) $4ab^2\sqrt[3]{a^2}$ (b) $4a^2b^3\sqrt[3]{a}$ (c) $8ab^2\sqrt[3]{a^2}$ (d) $8a^2b^3\sqrt[3]{a}$

76.) The expression $\left(\sqrt[3]{27x^2}\right)\left(\sqrt[3]{16x^4}\right)$ is equivalent to

(a) $12x^2\sqrt[3]{2}$ (b) $12x\sqrt[3]{2x}$ (c) $6x\sqrt[3]{2x^2}$ (d) $6x^2\sqrt[3]{2}$

77.) Which value of k satisfies the equation $8^{3k+4} = 4^{2k-1}$

(a) -1 (b) $-\frac{9}{4}$ (c) -2 (d) $-\frac{14}{5}$

78.) Simplify into standard $a + bi$ form: $i^3 - 3i^{11} + 2i^8 - 4i$

79.) Solve for a and b: $(\sqrt[3]{27})^4 = a^b$ (Hint: there are many possible correct answers)

80.) On Monday, Tommy paid $7.20 for 3 coffees, 2 donuts and 6 cookies. On Tuesday, he paid for $7.80 for 4 coffees, 4 donuts and 1 cookie. On Wednesday, he paid $7.70 for 2 coffees, 2 donuts and 10 cookies. What is the individual price for a coffee, a donut and a cookie? What would he pay for 1 coffee, 1 donut and 1 cookie? Solve **algebraically** for all answers to this question.

81.) During a 1-year period, a population of tropical insects grew according to the model $P = P_0(1.46)^t$, where P is population, P_0 is the initial population, and t is time in years. Which equation can be used to model the approximate weekly growth rate? (Assume 52 weeks in a year.)

(a) $P = P_0(1.0073)^{52t}$

(b) $P = P_0(1.0088)^{52t}$

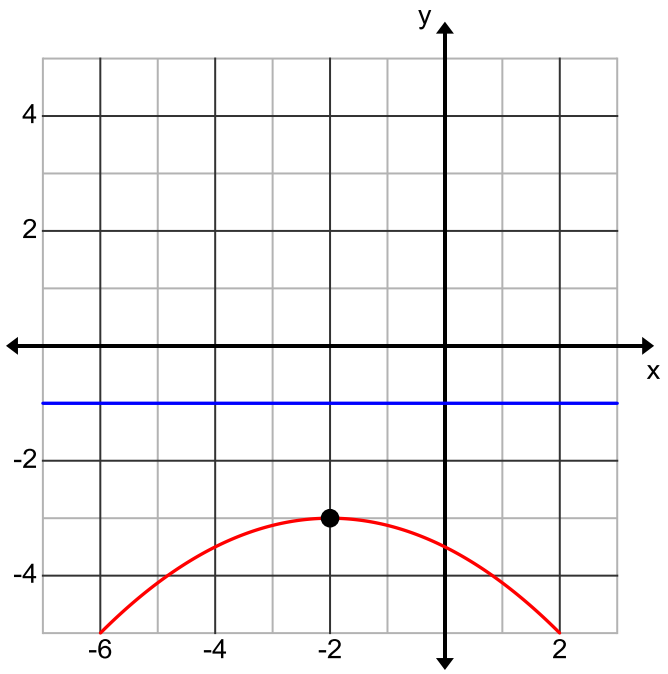
(c) $P = P_0(1.0281)^{52t}$

(d) $P = P_0(1.0371)^{52t}$

82.) What extraneous solution arises when the equation $\sqrt{x+3} = 2x$ is solved for x by first squaring both sides of the equation?

83.) Write the equation of a parabola whose focus is $(2,4)$ and vertex is $(4,4)$.

84.) Write the equation of the parabola shown in the graph:



85.) Solve **algebraically** for all values of x: $81^{x^3+2x^2} = 27^{\frac{5x}{3}}$

86.) Solve **algebraically** for all values of x, y, z: $2x - 6z - y = 2$
$4y - 4x + 6z = 2$
$x - 5y = 2z$

87.) Simplify: $\sqrt[3]{40} + 2\sqrt[3]{-5}$

88.) Find $f^{-1}(x)$ given $f(x) = \frac{x+1}{x-3}$.

89.) If n > 0 , the expression $\left(\frac{1}{n}\right)^{-\frac{2}{3}}$ is equal to:

(a) $-n^{\frac{2}{3}}$ (b) $-n^{\frac{3}{2}}$ (c) $\sqrt[3]{n^2}$ (d) $\sqrt{n^3}$

90.) Find the equation of a parabola with vertex (-1,2) and focus (1,2).

a. $x + 1 = \frac{1}{8}(y-2)^2$ b. $x + 1 = -\frac{1}{8}(y-2)^2$

c. $x + 1 = \frac{1}{4}(y-2)^2$ d. $y - 2 = \frac{1}{8}(x+1)^2$

91.) Simplify $8i^6 + 6i^5 - 5i^3 - 3i^2 - 7i - 9$

a. $-14+4i$ b. $-4+4i$ c. $-10i$ d. $-14-18i$

92.) Write the following using radical notation.

Assume that all variables represent positive real numbers: $-16x^{\frac{3}{4}}$

a. $-8\sqrt[4]{x^3}$ b. $8\sqrt[4]{x^3}$ c. $-16\sqrt[4]{x^3}$ d. $\sqrt[4]{(-16x)^3}$

93.) Algebraically determine the points of intersection for $x^2 + y^2 = 1$ and $y = x + 1$.

a. (0, -1) and (1,0) b. (-1,0) and (0,1) c. (1,0) and (0,1) d. (-1,0) and (1,1)

94.) Which of the following could identify the transformation of a parabola with a vertex of (-4,-6) to a parabola with a vertex of (1,-6)?

a. $f(x)+5$ b. $5f(x)$ c. $f(x+5)$ d. $f(x-5)$

95.) The expression $x^2(x-5)-25(x-5)$ is equivalent to $(x-5)^n(x+5)$ when *n* equals

a. 0 b. 1 c. 2 d. 3

96.) Consider solving $x^2 - 7x + 15 = 0$ by completing the square. At which of the following equations will you arrive?

a. $\left(x+\frac{7}{2}\right)^2 = -\frac{11}{4}$ b. $\left(x+\frac{7}{2}\right)^2 = -\frac{37}{4}$

c. $\left(x-\frac{7}{2}\right)^2 = -\frac{23}{4}$ d. $\left(x-\frac{7}{2}\right)^2 = -\frac{11}{4}$

97.) Sarah graphs the function $g(x) = 5x^2 + 30$ and observes that $g(x)$ has no *x*-intercepts. She uses this information to conclude that there are no solutions to the equation $5x^2 + 30 = 0$. To verify her conclusion, Sarah solves the equation $5x^2 + 30 = 0$ algebraically and gets two solutions. Which statement is true about this situation?

a. Sarah's original conclusion was correct. There are no solutions to the equation $5x^2 + 30 = 0$. She made a mistake when solving the equation algebraically.
b. Sarah's original conclusion was false. The equation has two complex solutions, -6*i* and 6*i*.
c. Sarah's original conclusion was false because she graphed $g(x)$ incorrectly. The *x*-intercepts of $g(x)$ are $\pm\sqrt{6}$ and these values are also the solutions to the equation $5x^2 + 30 = 0$.
d. Sarah's original conclusion was false. The equation has two complex solutions of $\pm i\sqrt{6}$.

98.) Part A: Verify algebraically that $(x + 2)$ is a factor of $x^3 + 7x^2 + 14x + 8$.

Part B: Find algebraically all the zeros of $f(x)$.

99.) Solve algebraically.

$x - y + z = -1$
$x + y + 3z = -3$
$2x - y + 2z = 0$

$a + b + c = -3$
$b - c = 4$
$2a - b - 2c = -5$

100.) The length of a rectangle is three more than twice the width. Determine the dimensions that will give a total area of 27m^2.

101.) The roots of the equation $2x^2 + 4x = 9x$ are

b. Real, rational, and equal
b. Real, rational and unequal
c. Real, irrational, and unequal
d. Imaginary

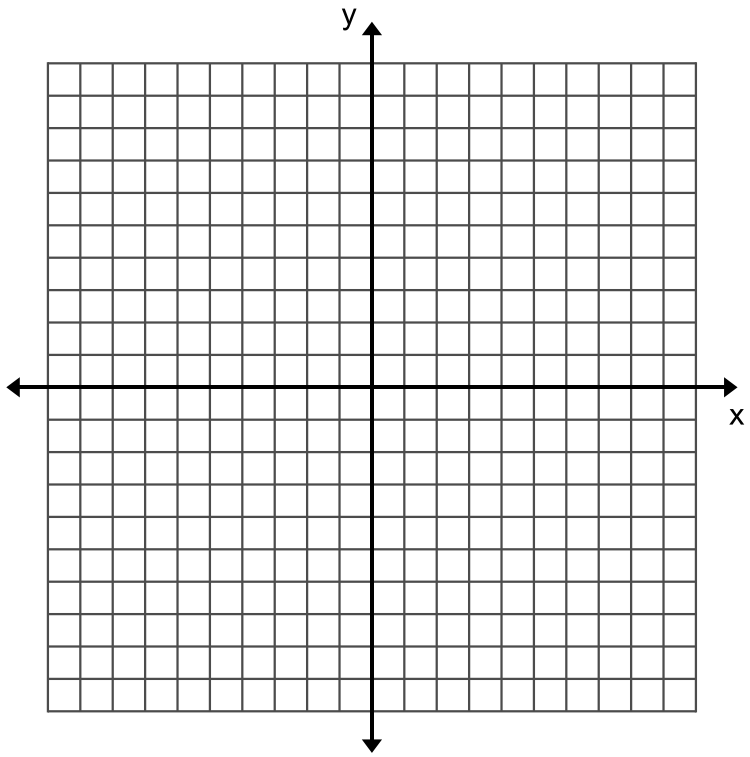
102.) What is the vertex of the parabola $6y - 12 = (x - 3)^2$?

$(-3, -2)$ b. $(3, 12)$ c. $(3, 2)$ d. $(3, -12)$

103.) Prove that $x = \sqrt{-5x - 6}$ has no solution.

104.) Write $(5 + 2yi)(4 - 3i) - (5 - 2yi)(4 - 3i)$ in $a + bi$ form, where y is a real number.

105.) $f(x) = -(x-2)^2 + 5$



a. Graph the equation.

b. What is the domain?

c. What is the range?

Round all values to the *nearest tenth*.

d. Over what interval of the domain is the graph:

Increasing _____

Decreasing _____

e. Over what interval(s) of the domain is the graph:

$f(x) > 0$ _____

$f(x) < 0$ _____

f. Find the average rate of change over the interval $[-3, 3]$.

106.) Refer to the following equation to answer the questions below.

$$x = -2y^2 + 12y - 20$$

a. Find the equation of the parabola in vertex form.
b. Use this equation to state the vertex, focus, and directrix.
c. Sketch a graph.

107.) Find the equation of the parabola with vertex $(0,0)$ and directrix $x = -6$.

108.) Find the equation of the parabola with vertex $(4,6)$ and focus $(4,-2)$.

109.) Write the quadratic equation when given the root, $r_1 = 2 - \sqrt{5}$.

110.) The height, h, in feet, a ball will reach when thrown in the air is a function of time, t, in seconds, given by the equation: $h(t) = -8t^2 + 25t + 3$.

a. Find, *to the nearest hundredth*, the maximum height, in feet, the ball will reach.

b. Find $f(3)$ and describe what it represents in the context of this problem.

c. Find, to the *nearest hundredth*, how many seconds it takes for the ball to reach the ground.

d. At what time(s) is the ball at a height of 16 feet? Round to the nearest hundredth.

111.) What is the equation of the quadratic, with integer coefficients, whose roots are $\frac{4}{5}$ and $-\frac{2}{3}$?

a. $3x^2 + 7x - 6 = 0$

b. $x^2 - \frac{4}{5}x + \frac{2}{3} = 0$

c. $6x^2 + 7x + 3 = 0$

d. $15x^2 - 2x - 8 = 0$

112.) Does the function $y = 4^{-2x}$ represent exponential growth or decay? What is the percent rate of change?

a. Exponential growth; 4%
b. Exponential decay; 93.75%
c. Exponential growth; 83.3%
d. Exponential decay; 6.25%

113.) Find the percent change to the nearest percent for the following function: $f(x) = 2(1-0.3)^{-x}$

a. 30%
b. 43%
c. 70%
4. 60%

114.) Which of the following expression is equal to *a*?

a. $\left(a^b\right)^{\frac{1}{b}}$ b. $\left(a^b\right)^b$ c. $\frac{a^b}{a^b}$ $\left(a^b\right)^{-\frac{1}{b}}$

115.) Given $m(x)=4x^3-6$, find $m(x)^{-1}$.

a. $-4x^3+6$ b. $\sqrt[3]{\frac{x+6}{4}}$ d. $\frac{1}{4x^3-6}$ d. $\sqrt[3]{4x-6}$

116.) Find the points of intersection of the line $y=x+1$ and the circle $x^2+y^2=25$ algebraically.

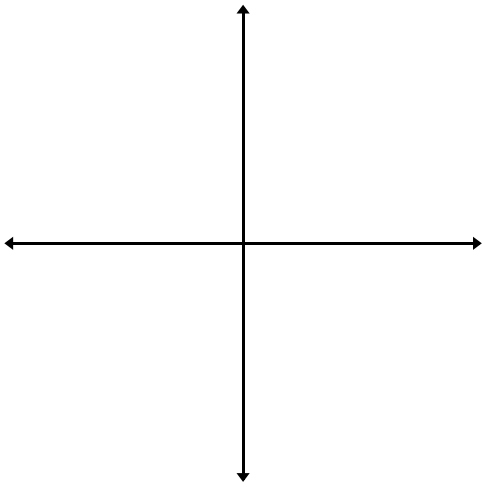
117.) Solve $\sqrt{3x+1}=x-1$ algebraically.

118.) Given $g(x) = -x^2 - 2x + 7$

a. Find $g(-1)$

b. Find the zeroes of the function algebraically

119.) Graph the product of $(-2 + 3i)$ and $(4 - 6i)$



120.) Solve for x in terms of a, b, and c: $\sqrt{ax + b} - c = 0$

121.) If $a < 0$, $b < 0$ and $c > 0$ The roots of the quadratic $ax^2 + bx + c$ are :

a) Two Real Equal Roots

b) Two Real Unequal Roots

c) Two Imaginary Equal Roots

d) Two Imaginary Unequal Roots

122.) Express as a product of binomials: $2x^3 + 21 - 6x - 7x^2$

123.) Write a quadratic with roots $r_1 = 1 - \sqrt{2}$, $r_2 = 1 + \sqrt{2}$

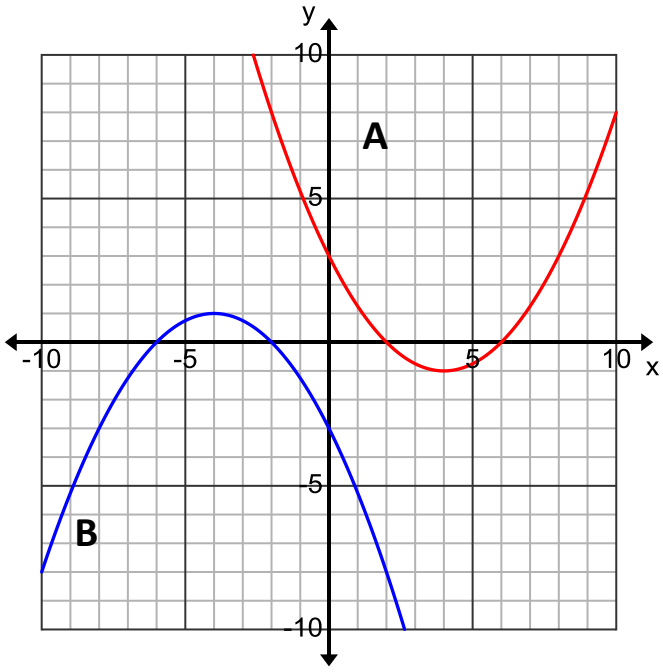
124.) Given f(x) = $-\frac{1}{4}(x-4)^2 + 1$

a. A = $f(x)$

b. B = $f(x)$

c. A = $f(-x)$

d. B = $f(-x)$



125.) Solve for x and y: $(2-3i)^2 = 2i(x-yi)$

126.) Given the quadratic $y = 5x^2 - 54x + 81$ find the average rate of change over the interval [1,5]

127.) Subtract and express your answer in simplest form: $\frac{x}{x^2-x-30} - \frac{1}{x+5}$

128.) Find the focus of the parabola algebraically $x^2 + 12 - 2y + 8x = 0$

129.) Given the focus (-2,7) and the directrix x = 4, write the equation for the parabola.

130.) Solve algebraically:

$$3x + 4y - z = 17$$
$$5x - y + 2z = -2$$
$$2x - 3y + 7z = -21$$

140.) Solve for x: $3(x+1)^{4/3} = 48$

141.) The expression $(x^2-3)^{-\frac{3}{4}}$ is equivalent to:

(a) $\frac{1}{\sqrt[4]{(x^2-3)^3}}$

(b) $\sqrt[4]{(x^2-3)^3}$

(c) $\sqrt[4]{(-x^2+3)^3}$

(d) $\frac{1}{\sqrt[3]{(x^2-3)^4}}$

143.) Solve for all real values of x: $2(x-7)^{\frac{1}{2}} - 5 = 0$

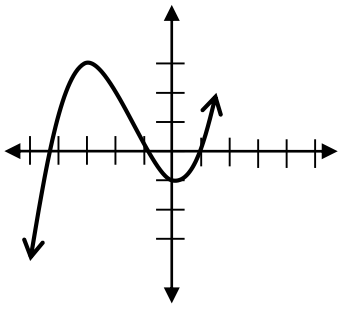
144.) Solve for all real values of x: $\sqrt{10x^2-21x} = 10^{\frac{1}{2}}$

146.) Solve for a: $(x^2y^a)^2 = \frac{x^4}{y^2}$

147.) Solve for x : $4^{x^2-3x} = 1$

148.) Consider the graph of f(*x*).

a. Approximate the interval(s) where the function is increasing.
b. Approximate the interval(s) where the function is decreasing.
c. Approximate the relative maximum of the function.
d. Approximate the relative minimum of the function.



149.) Write an equation, in standard form, of a polynomial that has 1, 2, and 2 – *i* as zeros.

150.) Describe the difference between the graphs of *f*(*x*) and $g(x) = -f(x+2) - 5$.

151.) Divide $x^3 - 10x^2 + 20x + 26$ by $x - 5$

152.) Solve for x: $32 = 8^{2x-1}$

153.) Find the amount of money you will have after 10 years if $15,000 is invested in accounts paying 6% interest compounded:

e. Annually
f. Quarterly
g. Monthly
h. Daily
i. Continuously

154.) Would it be better to invest $10,000 for 8 years at 8% interest compounded quarterly or 6.5% interest compounded continuously?

155.) Given $g(x) = x^4 - x^3 + x^2 - 3x - 6$

a. Use the remainder theorem to find any initial zeroes
b. Completely factor the polynomial
c. Find all of the zeros

156.) The population of a city is given by $P = 140{,}500e^{kt}$, where t = 0 corresponds to the year 1990. In 1960, the population was 100,250. Find the value of k to the nearest ten thousandth and use this result to predict the population in the year 2000.

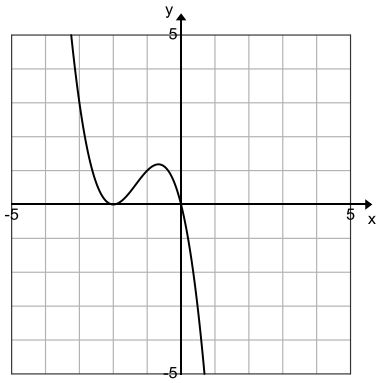
157.) During normal breathing, about 12% of the air in the lungs is replaced after one breath. Write an exponential decay model for the amount of the original air left in the lungs if the initial amount of air in the lungs is 500 mL. How much of the original air is present after 24 breaths? Round your answer to the nearest mL.

158.) Find the quotient and remainder by synthetic division: $\dfrac{x^4 - 10x^2 - 2x + 4}{x + 3}$

159.) Given the function $f(x) = 2x^3 + 3x^2 - 8x + 3$, find all zeros

160.) Find the zeros of $x^3 - 2x^2 - 9x + 18 = 0$ by factoring.

161.) Write an equation for the function pictured to the right. Leave your answer in factored form.



162.) Write a cubic equation, in standard form, with roots 4 and $1 - 2i$.

163.) Find the zeros of $x^3 - 4x^2 - 25x + 100 = 0$.

164.) Given $g(x) = 2x^4 + 7x^3 - 4x^2 - 27x - 18$, find the roots by synthetic division.

165.) Divide $x^4 + 5x^3 + 6x - 2$ by $x + 3$. State the quotient and remainder.

166.) Divide $4x^3 - 5x^2 - 16x + 20$ by $4x - 5$. State the quotient and remainder.

167.) The projected worth, in millions of dollars, of a large company is modeled by the equation $y = 236(1.04)^x$ The variable *x* represents the number of years since 1997. What is the projected annual percent of growth? What should the company be worth in 2004?

168.) A population of 340 animals decreases at an annual rate of 15%. Write an exponential model to represent this situation. Use this model to find the number of animals after 5 years.

169.) Solve for x: $\frac{1}{25} = 125^{6x+4}$

170.) A population is growing at the rate of 5% per year. If there are 126 million people, how many will there be in 3 years (in millions rounded to the nearest million)?

171.) Solve for x: $9^{2x+1} = 27^{x-5}$

172.) Solve for x: $8^{2x-3} = \left(\frac{1}{16}\right)^{x-2}$

173.) If Lilly deposits $3,900 into a savings account earning 3.5% interest per year, find how much she'll have after 8 years if the interest is compounded

a. Annually
b. Quarterly
c. Monthly
d. Continuously

174.) The population, P, of six towns with time t, in years, are given by:

(i) $P = 1000(1.08)^t$

(ii) $P = 600(1.12)^t$

(iii) $P = 2500(0.9)^t$

(iv) $P = 1200(1.185)^t$

(v) $P = 800(0.78)^t$

(vi) $P = 2000(0.99)^t$

Which towns are growing in size?
Which towns are shrinking?
Which town is growing the fastest?
What is the annual percent growth rate for the town from part (c)?
Which town is shrinking the fastest?
What is the annual percent "decay" rate for the town from (e)?
Which town has the largest initial population (at $t = 0$)?
Which town has the smallest initial population (at $t = 0$)?

175.) Solve the equation for x: $\frac{3}{x}-\frac{1}{4}=\frac{1}{3}$

[A] $\frac{4}{7}$ [B] $\frac{36}{7}$ [C] 10 [D] $\frac{21}{2}$

176.) Solve the equation for x: $\frac{x}{x-3}=\frac{3}{x-3}+9$

[A] 0 [B] 3 [C] $\frac{24}{9}$ [D] $\varnothing$

177.) Solve the equation for x: $3-\frac{x+1}{x+2}=\frac{11x-2}{x+2}$

[A] $\frac{5}{9}$ [B] $\frac{7}{9}$ [C] 1 [D] $\frac{9}{7}$

178.) You inherit \$2500 with the stipulation that for the first year the money must be invested into two stocks paying 10% and 6% annual interest, respectively. How much should be invested at the 10% rate if the total interest earned for the year is to be \$221.92?

[A] \$449.50 [B] \$702 [C] \$1798 [D] \$2219.20

179.) After a 7% increase in salary, Laurie makes \$1016.50 per month. How much did she earn per month before the increase?

[A] \$871.29 [B] \$ 945.35 [C] \$950 [D] \$1087.66

180.) Solve the following equation for x. **If there are two solutions, state their sum.** ***If there is one solution, state that answer.***: $5x^2=4$

[A] 0 [B] $\frac{2}{5}$ [C] $\frac{4}{5}$ [D] $\frac{2}{\sqrt{5}}$

181.) Solve the following equation for x. **If there are two solutions, state their sum.** ***If there is one solution, state that answer.***: $3x^2-2(x-2)=18-3x$

[A] $\frac{-5}{3}$ [B] $\frac{-1}{3}$ [C] $\frac{1}{3}$ [D] 0

182.) Solve the following equation for x. **If there are two solutions, state their sum.** ***If there is one solution, state that answer.***: $\sqrt{x+10} = x-2$

[A] 1 [B] 3 [C] 5 [D] 6

183.) State the domain of the following function: $y = \sqrt{3x-4}$

[A] $\left(\frac{3}{4}, \infty\right)$ [B] $\left[\frac{3}{4}, \infty\right)$ [C] $\left(\frac{4}{3}, \infty\right)$ [D] $\left[\frac{4}{3}, \infty\right)$

184.) State the domain of the following function in interval notation: $f(x) = \frac{5}{\sqrt{x+7}}$

[A] $(-7, \infty)$ [B] $[-7, \infty)$ [C] $(-\infty, \infty)$ [D] $(-\infty, -7) \cup (-7, \infty)$

185.) If $f(-x) = -f(x)$ for every value of x in the domain of the function f, then which one of the following is true about f?

[A] f is called an odd function and its graph is symmetric about the y-axis.

[B] f is called an even function and its graph is symmetric about the y-axis.

[C] f is called an odd function and its graph is symmetric about the origin.

[D] f is called an even function and its graph is symmetric about the origin.

186.) The graph of $y = -3\sqrt{x} - 5$ can be obtained by doing which of the following transformations of the graph of $y = \sqrt{x}$?

[A] reflect about the x-axis, stretch by a factor of 3, shift up 5 units.

[B] shift down 5 units, reflect about the y-axis, stretch by a factor of 3.

[C] reflect about the x-axis, stretch by a factor of 3, shift down 5 units.

[D] reflect about the x-axis, shrink by a factor of 3, shift down 5 units.

187.) If $f(x) = \frac{3}{4}x - 2$, then $f^{-1}(x) =$

[A] $\frac{4}{3x-8}$ [B] $\frac{4}{3}x - \frac{8}{3}$ [C] $\frac{4}{3}x + \frac{8}{3}$ [D] $\frac{-4}{3}x + 2$

188.) Which one of the following functions will have a graph whose end behavior indicates that the graph will rise to the left?

[A] $f(x) = -2x^4 + 4x^2 - 6x + 9$

[B] $f(x) = x^5 - 4x^2 - 6x - 9$

[C] $f(x) = -\ 4x^5 - \ 4x^2 - 6x - 9$

[D] $f(x) = -3x^4 + 4x^2 - 6x + 9$

189.) Find the quotient and remainder for the following:

$$\left(5x^4 + 17x^3 + 10x^2 + 13x - 14\right) \div \left(x + 3\right)$$

[A] $5x^3 + 2x^2 + 9x + 14; -17$

[B] $5x^3 + 2x^2 + 4x + 13; -53$

[C] $5x^3 + 2x^2 + 4x + 1; -17$

[D] $5x^3 + 32x^2 + 106x + 331; 979$

190.) If the number 3 is a zero of a polynomial function $f(x)$, then which of the following is true?

[A] $x - 3$ is a factor of $f(x)$

[B] $x + 3$ is a factor of $f(x)$

[C] -3 is a zero of $f(x)$

[D] $f(-3) = 0$

191.) Which one of the following equations have the given roots, 3 and $-4i$?

[A] $x^3 - 3x^2 + 16x - 48$

[B] $x^3 + 3x^2 + 16x + 48$

[C] $x^3 - 3x^2 - 16x + 48$

[D] $x^3 + 3x^2 - 16x - 48$

192.) State the domain of the following function in interval notation: $f\left(x\right) = \dfrac{x-2}{x+2}$

[A] $(-\infty, 2) \cup (2, \infty)$

[B] $(-\infty, -2) \cup (-2, \infty)$

[C] $\left(-\infty, \infty\right)$

[D] $(-\infty, -2) \cup (-2,2) \cup (2, \infty)$

193.) Find the $x-$intercept: $f(x) = \dfrac{5-x}{x+5}$

[A] (0, 1) [B] (5, 0) [C] (1, 0) [D] (–1, 0)

194.) The number of spiders, $S(t)$, remaining within a 10-foot radius of their birthplace *t* days after birth is given by the formula: $S(t) = 200\left(2^{-0.2t}\right)$. Find the number of spiders present within this radius 10 days after their birth.

[A] 0 [B] 5 [C] 50 [D] 800

195.) If $4500 is invested at a rate of 8% compounded quarterly, then **how much interest** will be earned at the end of 6 years? Hint: $A = P\left(1+\frac{r}{n}\right)^{nt}$

[A] $353,235.81 [B] $24,035.31 [C] $7237.97 [D] $2737.97

196.) The growth in the population of a biology experiment fits $A(t) = 445e^{.013t}$ where t is the number of years since 1987. Estimate the population in the year 2000.

[A] 527 [B] 451 [C] 264 [D] 534

197.) What is the range of $f(x) = 2^{x+3} - 1$?

[A] $(-\infty, \infty)$ [B] $(-1, \infty)$ [C] $(-3, \infty)$ [D] $(3, \infty)$

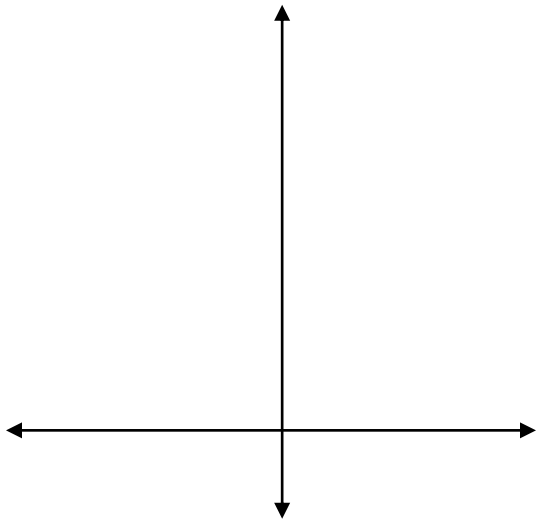
198.) If $2500 is invested in the account that pays interest compounded continuously at a rate of 4%, how long will it take to double the investment? Hint: $A = Pe^{rt}$

[A] 2.8 years [B] 13.0 years [C] 14.2 years [D] 17.3 years

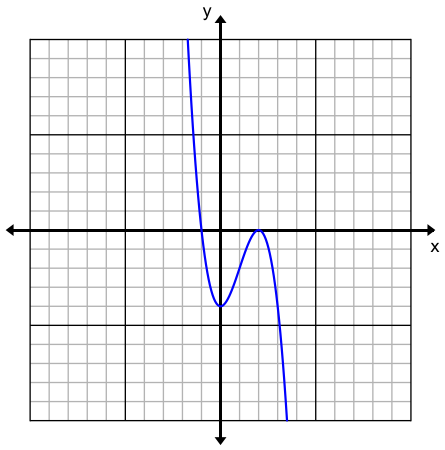
199.) Audrey and Cara took 2 hours to paint a room together. When painting separately, Audrey took three hours longer than Cara to pain the same size room. How long did it take each of them to paint a room separately?

200.) Given $g(x) = \frac{x}{x-3}$ find $g^{-1}(x)$.

201.) Create the sketch of a function $f(x) = -a(x+b)^2(x-c)(x-d)$ given that a, b, c and d are all positive and $c \neq d$.



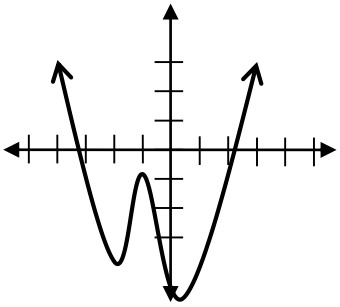
202.) State the real roots of the graph



203.) What is the smallest possible degree for the function?

204.) Is the leading coefficient positive or negative?

205.) Concerning the following graph of $f(x)$,



a) What is the smallest possible value for the degree?

b) Is the leading coefficient positive or negative?

c) What would the real roots of $f(x+2)$ be?

206.) Divide $x^3 - 4x^2 - 25x + 100$ by $x - 4$. What is the remainder?

207.) Is $\frac{2}{3}$ a zero of the polynomial $f(x) = 3x^3 - 26x^2 + 364x - 232$?

208.) Divide $3x^3 - 2x^2 + 4x - 1$ by $x + 1$ and express the quotient in the form $q(x) + \frac{r(x)}{d(x)}$

209.) What is the remainder when you divide $x^3 - x^2 - 14x + 11$ by $x - 4$?

210.) Find all the roots of the function $f(x) = x^3 + 2x^2 + 14x$ over the **complex numbers**.

211.) Divide $\frac{2x^4 - 8x^3 - 4x^2 - 16x + 1}{x - 3}$

Determine if the following functions are even, odd or neither.

212.) $f(x) = x^3 + 4$

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

214.) $f(x) = x^5 - 2x^3$

215.) $f(x) = x^3 - 3x^5 + 4$

216.) Graph and analyze: $f(x) = x^3 - 5x^2$

Domain: _____

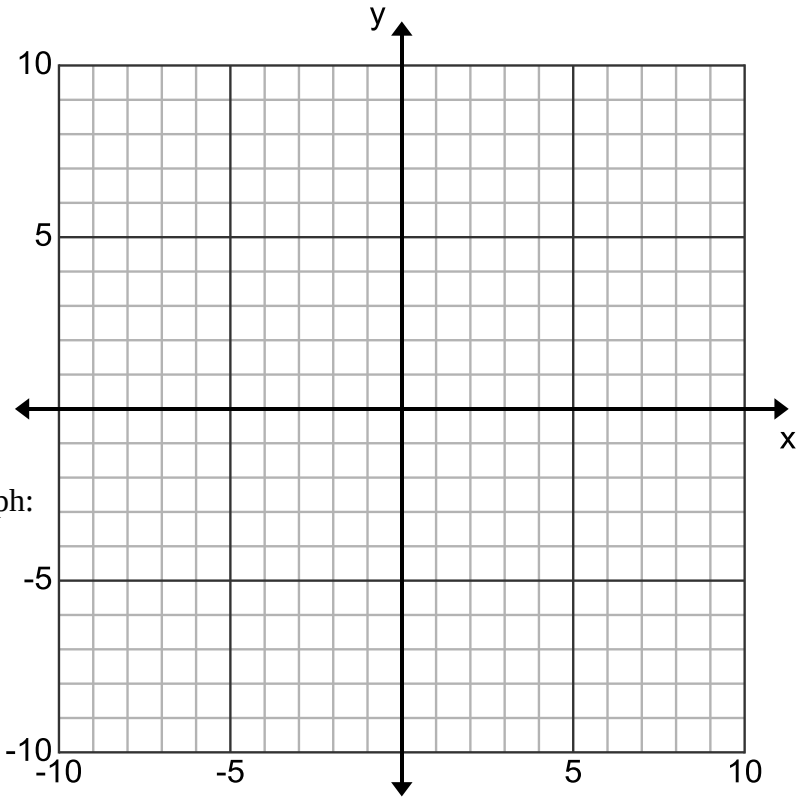
Range: _____

y-intercept:_____

Over what interval(s) of the domain is the graph:

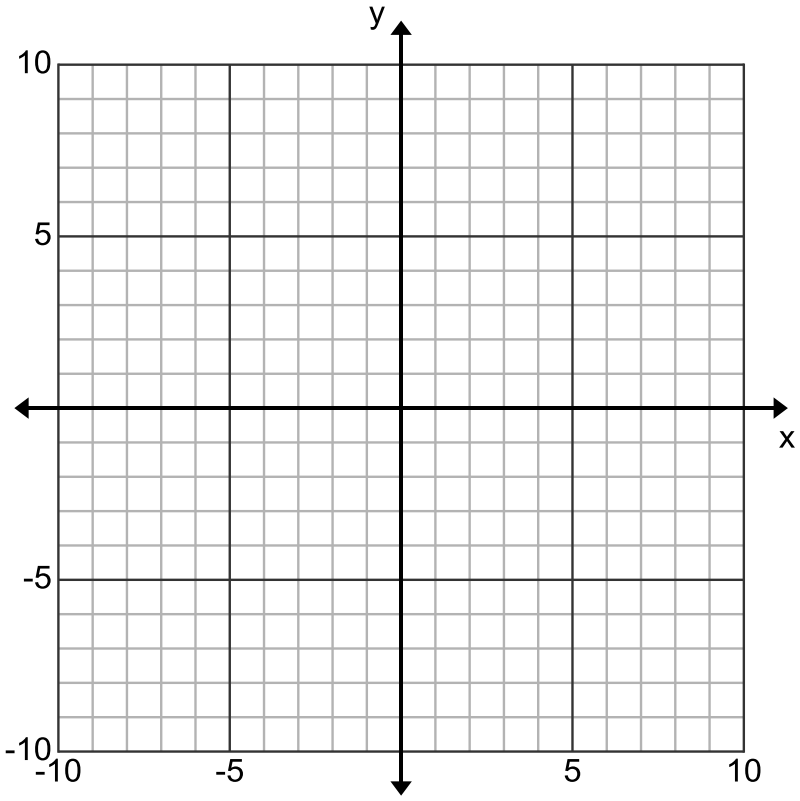
Increasing _____

Decreasing _____



217.) $f(x) = -(x+2)^2(x-5)^2$

Graph the polynomial on the axes provided.



Domain: _____

Range: _____

Relative Maximum(s):_____

Relative Minimum(s): _____

x-intercept(s):_____

y-intercept:_____

Over what interval(s) of the domain is the graph:

Increasing _____

Decreasing _____

Over what intervals of the domain is:

f(x) > 0 _____

f(x) < 0 _____

218.) *Write a polynomial in standard form with the following roots.* $\{-2+\sqrt{3}, 2\}$

219.) Solve for *x*: $\frac{3}{x+1} - \frac{2}{1-x} = 1$

220.) Solve for *x*: $\frac{5}{x-1} - \frac{2}{x+3} = \frac{20}{x^2+2x-3}$

221.) Factor completely over the reals: $54x^5 + 2x^2$

222.) Factor completely over the reals: $8x^6 - 27y^3$

223.) Simplify: $\frac{2x^3+5x^2-3x}{4x^2-1} \bullet \frac{2x^2-5x-3}{x^5-9x^3}$

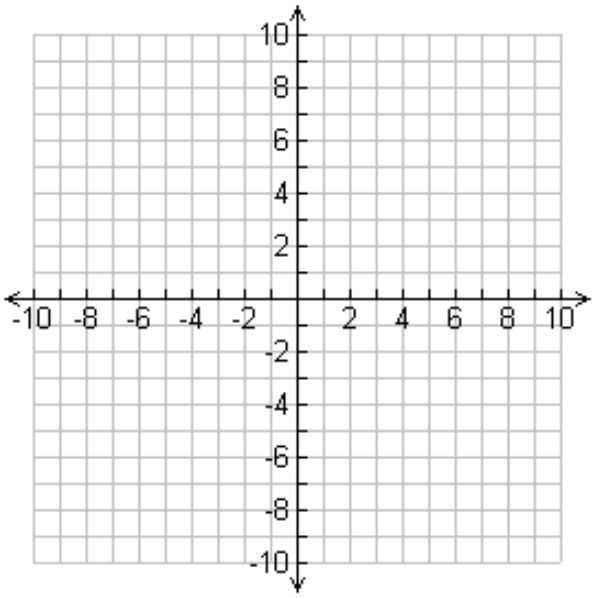
224.) Write the equation of the inverse for each of the following functions:

$f(x)=2x+8$ $\quad$ $g(x)=\frac{1}{x+1}-5$ $\quad$ $h(x)=\frac{x+2}{x-3}$

225.) Subtract and express your answer in simplest form: $\frac{x+2}{x-1}-\frac{14}{x^2+5x-6}$

226.) Sketch a graph of the following function: $h(x) = \dfrac{3x+7}{x+2}$.

a. Rewrite $h(x)$ so that you can describe the movement of the function in comparison to $f(x) = \dfrac{1}{x}$.



b. State the domain.

c. State the range.

d. State the equation of the vertical asymptote.

e. State the equation of the horizontal asymptote.

f. Over what interval(s) of the domain is the graph…

increasing?

decreasing?

g. As $x \to \infty$, $h(x) \to$_____.

h. As $x \to -\infty$, $h(x) \to$_____.

i. What is the average rate of change over the interval [0,3]?

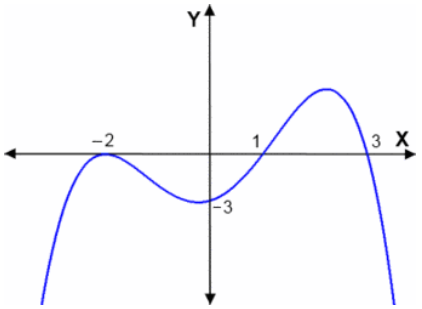
227.) Which of the following functions could represent the graph to the right?

(A) $f(x) = -(x-1)(x+2)^2(x-3)$

(B) $f(x) = (x-1)(x+2)^2(x-3)$

(C) $f(x) = (x+2)^2(x-1)(x-3)$

(D) $f(x) = x^2(x+2)(x-1)$



228.) What are the directional changes and numerical changes of the vertex of the graph of the equation $y = x^2$ when it changes to the equation $y = -3 + (x + 2)^2$?

(a) right 2 units and up 3 units

(b) left 3 units and up 2 units

(c) left 2 units and down 3 units

(d) left 2 units and up 3 units

229.) Consider the graph and use it to answer these questions.

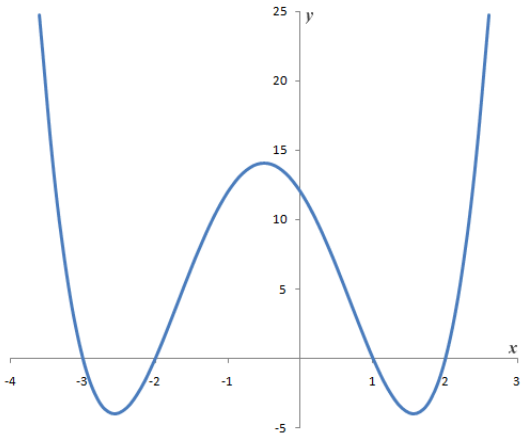
Which set lists all of the real solutions of f(x) = 0

(a) {-2,-3,1,0}

(b) {0,1,2,-3}

(c) {-3,-2,1,2}

(d) {12}



Which is most likely the degree of f(x)?

(a) 1 (b) 2 (c) 3 (d) 4

230.) What is the quotient when $6x^2 + 7x + 2$ is divided by $2x + 1$?

(a) $3x + 7$ (b) $3x + 5$ (c) $3x + 2$ (d) $3x + 3.5$

231.) Find the product of $\frac{6x-3}{4x+8}$ and $\frac{2x+4}{4x^2-1}$.