**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ *Midterm Review 2017***

**✰My Plan for completing the ✰ Exam Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**review packet is as follows… ✰ Exam Format:**

 **40 multiple choice (2 points each)**

 **Choice of 12 short answer (3 points each)**

 **Choice of 4 long answer (6 points each)**

 **✰ You will be allowed to use a scientific (not graphing) calculator for this exam.**

 **✰ You will be have two class periods to review before the exam date.**

**✰I also plan on doing the following to review for the exam:**

 **⭘ Reading through notes.**

 **⭘ Re-doing previous class/home work problems.**

 **⭘ Re-doing previous quiz/test problems.**

 **⭘ Reading my textbook.**

 **⭘ Using online resources/videos.**

 **⭘ Seeing my teacher to ask questions.**

 **⭘ Collaborating with my peers.**

 **⭘ Other: Please describe below.** ☺

**Midterm Review: Function Foundations**

1. Define the terms **domain**, **range**, and **function**.

Also explain what a function is in terms of domain and range.

2. What is the “vertical line test,” and how is this helpful when it comes to working with functions?

3. **Use the functions below to answer each question.**

 *b*(*x*) = *x*2 + 2  *c*(*x*) = 3 *d*(*x*) = 2*x* + 3 *f*(*x*) = *x*3

 **Determine each of the following.**

a. (b ○ d)(*x*) b. (b • d)(*x*) c. b(f(c(x)) d. b(x)d(x)

e. b(f(x)) f. (d ○ f)(*x*) g. 2b(x) – 3d(x) h. (d – c)(x)

i. d(b(f(x)) j. (f ○ c)(*x*) k. (d ○ b)(*x*) l. (b • f)(*x*)

4. Given *f*(*x*) = 3*x* and *g*(*y*) = 5y, sketch a graph of the system of inequalities formed by

 *f*(*x*) – *g*(*x*) ≤ 10

 *f*(*x*) – *g*(*x*) > -15



5. 7. Given *f*(*x*) = 2*x*2 – 8 and *g*(*x*) = 3x + 8, determine each of the following.

 a. *f*(-3) b. 3*f*(2) c. (*f* – *g*)(-1) d. (*f* – *g*)(4)

 e. *f*(*x* + 2) f. *f*(4*x*) g. 2*g*(-*x*) h. 3*f*(0)

6. A function has domain {-3, -2, 1, 4}. Another function has domain [-3, 4].

 How are these domains different?

7. State the domain and range of each function in both interval notation and inequality notation.

|  |  |
| --- | --- |
| Domain:Range:f(x) = -5, what is x?What is 3f(-4)?What is f(0) - f(5)?f(x) = 6. What is x? | Domain:Range:g(x) = 0, what is x?What is 2g(-10)?What is g(-15) + g(0)?What is g(10)? |

8. Describe even and odd symmetry, and provide a pictorial example of each.

9. Consider f(x) and g(x) pictured below.

|  |  |
| --- | --- |
|  | a. Is f(x) a function, relation, or both? Explain.b. Is g(x) a function, relation, or both? Explain.c. State the domain & range of f(x) and g(x), using both interval and inequality notation. |

d. What is f(2) + g(-2)? e. What is f(g(-8))?

f. f(x) = 4, what is x? g. What is (f • g)(8)?

h. What is f(12) – g(4) i. What is g(-7) – f(0) + g(-3)?

j. What is 2f(0)? k. What is ?

**Midterm Review: Function Transformations**

1. Consider any function in the form A\*f(Bx + C) + D

 Describe all of the effects A, B, C, and D have on the graph of the function.

2. A function m(x) is the result of contracting a function p(x) so it is twice as wide, and translating p(x)

 five units down and three units right.

 Determine values for f, g, and h to make the equation, m(x) = f\*p(x + g) – h true.

3. For each function,

- Describe the transformations that occur.

- State the domain and range of the function.

- Sketch a graph of the function.

|  |  |  |
| --- | --- | --- |
| a. f(x) = -3(x – 8)2 + 7Description of transformation:Domain & Range:Graphical Representation:plane.png\*Use the graph to check your domain and range! ☺ | b. g(x) = -¼ (x + 2)3 – 3Description of transformation:Domain & Range:Graphical Representation:plane.png\*Use the graph to check your domain and range! ☺ | c. h(x) =  Description of transformation:Domain & Range:Graphical Representation:plane.png\*Use the graph to check your domain and range! ☺ |
| d. j(x) = Description of transformation:Domain & Range:Graphical Representation:plane.png\*Use the graph to check your domain and range! ☺ | e. k(x) = 5|x – 3| + 1 Description of transformation:Domain & Range:Graphical Representation:plane.png\*Use the graph to check your domain and range! ☺ | f. m(x) = -½ |x + 2| - 3Description of transformation:Domain & Range:Graphical Representation:plane.png\*Use the graph to check your domain and range! ☺ |

4. Write an equation to represent each function.

a. An absolute value function is made twice as wide, shifted 3 units left, and 4 units up.

b. A cubic function is reflected over the y-axis, and translated 5 units to the left.

c. A quadratic function is reflected across the x-axis, made ½ as wide, and shifted 6 units up

 and 11 units to the right.

d. A radical function is reflected across both axes, and translated 9 units down.

5. Consider the function d(x) = 4x2 + 2x.

a. Describe the transformation that maps the graph of d(x) to d(x – 3) + 2.

b. Write a function that defines d(x – 3) + 2.

6. Consider the function, j(x), pictured below. a(x) = j(x + 3) – 1 and b(x) = j(-x) – 3.



a. What are the domain and range of a(x)? b. What are the domain and range of b(x)?

7. The domain of a function, d(x) is ****and the range is ****.

 Determine the new domain **or** range for each.

 a. –d(x) b. d(-x) c. d(x – 7) d. d(x) + 7

8. r(x) is a radical function reflected the x-axis and translated right 2 units.

t(x) is defined as , and s(x) is defined as 

a. Compare and contrast the domain and range of r(x) and t(x).

b. Compare and contrast the domain and range of r(x) and s(x).

c. Compare and contrast the domain and range of s(x) and t(x).

9. Consider the functions b(x) = 5x4 + 3x2 + 1, c(x) = 2x2 – x4, and d(x) = x3 – x.

a. Prove algebraically whether d(x) is even, odd, or neither.

b. Prove algebraically whether (b – c)(x) is even, odd, or neither.

c. Prove algebraically whether (b + d)(x) is even, odd, or neither.

10. a. Will the function f(x) = (x + 1)2 + 9 have any real roots? Why or why not?

b. Which equation will not have any real solutions for x, and how do you know?

 Equation 1: -|x – 3| + 8 = 0 Equation 2: -|x + 3| - 8 = 0

**Midterm Review: Algebraic Systems**

1. An exam worth 145 points contains 50 questions. Some of the questions are worth two points each, and the rest are worth five points each. How many two-point questions are on the test? How many five-point questions are on the test?

 a. Define the variables, and write a system of equations that represents the situation.

 b. Solve the problem.

2. Solve the system below.

 *r* + 4*s* – *t* = 9

 6*r* + 3*s* – 5*t* = -11

 4*r* – 4*s* – 3*t* = -26

3. a. Sketch a graph of the system, and shade the solution set.

 b. State any point that is included in the solution set.

 

4. Determine the solution to each system.

 a. 5*x* + 4*y* = 36 b. *y* = -4*x* + 4

 5*x* + 4*y* = 12 *y =*

5. Sketch the solution to each system of inequalities.

 a.  b. 

  

6. Determine the number of solutions each system will have.

 a.  b. 

7. Is (1, -2) a solution to the system below? Explain.

 

8. Does every system of non-linear equations have exactly one solution? Explain.

9. Cary babysists for $9 per hour and tutors for $15 per hour. She cannot work more than 17 hours per week. She can tutor for no more than 4 hours per week, and she wants to make at least $95. Let x represent the number of hours Cary babysits per week and y represent the number of hours she tutors each week. Write a system of inequalities that could be used to represent the situation.

10. Consider the equation. Describe the simplest way to determine the solution(s) to the equation. You do not need to actually solve.

11. How could you solve the equation 5x2 – 8x = 19 without using the quadratic formula?

12. The manufacturing cost of producing x units of a product is modeled by the function c(x) = 12x, and the revenue earned from selling x units of the product is modeled by the function r(x) = x2 - 6x. What is the minimum number of units the company should create and sell in order to break even or make a profit?

13. Consider the function *f(x)* = |*x* + 4| - 3.

a. Create any function *j(x),* for which there will be exactly one solution to *j(x)* = *f(x*), and explain the reasoning that supports your choice.

b. Create any function *p(x),* for which there will be no real solutions to *f(x)* = *p(x*), and explain the reasoning that supports your choice.

c. Create any function *m(x),* for which there will be infinitely many solutions to *m(x)* = *f(x*), and explain the reasoning that supports your choice.

**Midterm Review: Quadratics**

1. Simplify each expression.

a. (2 + 3*i*) – (-8 – 2*i*) b. (-3 – 7*i*) + (-3 – 10*i*) c. *i*27

d. (3 + 2*i*) – 4*i*(8*i* – *i*2) e. *i*208 f. (*i* + 8)2 – 9*i*3

g. (-4 – 9*i*)(-5 + 10*i*) h. *i*83 \* 4*i*2 i. 

j. ( + 9) – 2*i*(6*i* – 9) k.  l. *i*3(7*i* – 1) - 3*i*(*i*5 – 4)

2. What is “the discriminant,” and why is the discriminant helpful in working with quadratics?

3. Solve each equation.

a. (r – 9)2 – 3 = -2 b. 5p2 + 245 = 0 c. 5x2 – 15x = -14

4. Factor each expression completely.

a. 18m3 – 27m2 + 4m – 6 b. b4 – 81

c. r3 – 5r2 – 24r d. 49k2 – 169

e. 3x2 – 51x + 216 f. 5q2 + 13q – 6

g. 2x4 – 9x2 + 4 h. 3x3 +x2 – 12x – 4

5. Determine the y-intercept, axis of symmetry, and vertex for each function.

a. f(x) = 3x2 – 6x + 8 b. y = -(x – 1)2 + 3 c. y = x2 + 8x + 15

y-intercept: \_\_\_\_\_\_\_\_\_\_ y-intercept: \_\_\_\_\_\_\_\_\_\_ y-intercept: \_\_\_\_\_\_\_\_\_\_

Axis of Symmetry: \_\_\_\_\_\_\_\_\_ Axis of Symmetry: \_\_\_\_\_\_\_\_\_ Axis of Symmetry: \_\_\_\_\_\_\_\_

Vertex: \_\_\_\_\_\_\_\_\_\_\_ Vertex: \_\_\_\_\_\_\_\_\_\_\_ Vertex: \_\_\_\_\_\_\_\_\_\_\_

6. Simplify.

a.  b.  c.  d. 

7. The legs of a right triangle have lengths (x + 4) units, and (x + 3) units, and the hypotenuse has a length of (2x + 5) units. Determine the perimeter of the triangle.

8. A ball is thrown into the air from the top of a building, and its altitude inn feet is given by the equation

 *h* = -16*t2 + 64*t *+* 48, where *t* is the elapsed time in seconds.

a. What is the maximum altitude of the ball?

b. How long will it take the ball to hit the ground? Explain.

9. An object is launched, and its altitude, *h*, in feet after *t* seconds is given by the equation

 *h* = -4.9*t*2 + 19.6*t* + 58.8.

a. Does the object start on the ground? How do you know?

b. When will the object reach its maximum height, and what is that height?

c. When will the object hit the ground? Explain.

10. A rectangular picture frame is three inches shorter than it is wide. The frame has an area of 108 square inches. Determine the perimeter of the frame.

11. Sketch a graph of each parabola.

|  |  |  |
| --- | --- | --- |
|  a. *f*(*x*) = *x*2 + 4*x* + 4 Macintosh HD:Users:boruch:Desktop:graph for system midsa.png | b. *f*(x) *= x*2 + 2*x* – 3 Macintosh HD:Users:boruch:Desktop:graph for system midsa.png | c. *y* = *x*2 – 1 Macintosh HD:Users:boruch:Desktop:graph for system midsa.png |

12. The parabolas in this problem are all the same width as the parent function, y = x2.

Part A: A parabola’s vertex is the same as it’s x-intercept, and its axis of symmetry is the line x = -3.

The parabola opens downwards. What is the equation of the parabola?

Part B: A quadratic function has no real solutions, and its vertex is at the point (1, -5).

 What is the equation for this function?