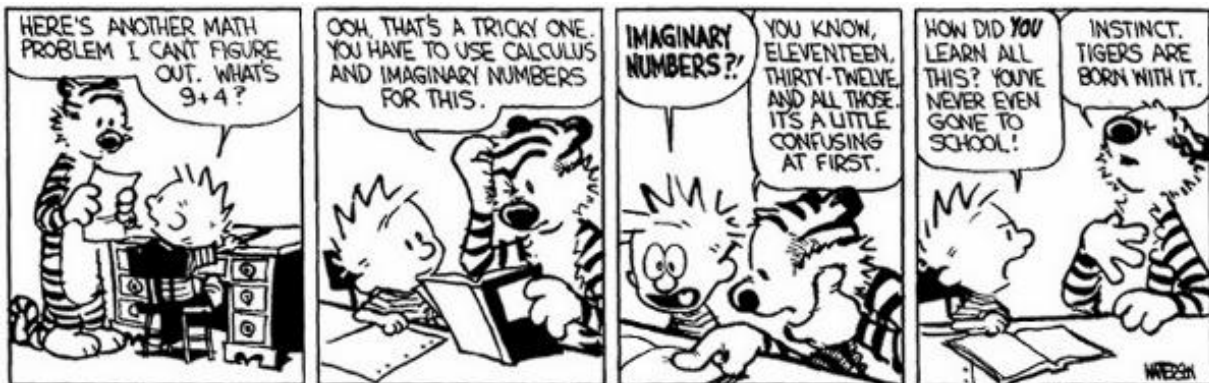# Math 120
Test 3C

Student Name: _____ Student Number: _____

Directions:

- SHOW ALL YOUR WORK OR JUSTIFICATION FOR ANSWERS _ON THE TEST_. Scrap paper is sometimes hard to read and I want to give you partial credit!
- Simplify all answers.
- Round answers as indicated.
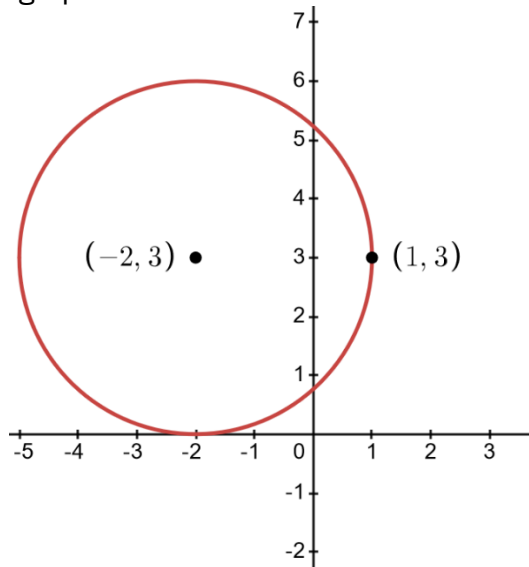- Include units with final answers.

Math 120 Test 3C

1. Use the following two points to answer the questions below: (-2,3) and (3,-9)

    a. Find the distance between the pair of points. (3 points)

    a._____

    b. Find the midpoint between the two given points. (2 points)

    b._____

2. The graph of the circle follows

    $(-2,3)$ • $(1,3)$

    a. Find the radius of the circle given that (-2,3) is the center. Show your work for full credit. (2 points)
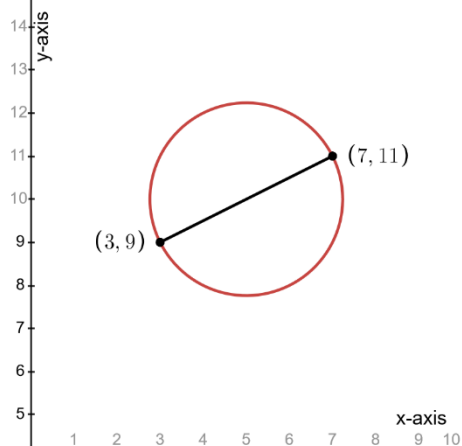
    a._____

    b. Use the graph and part a to write the equation of the circle in standard form. (3 points)

    b._____

Math 120 Test 3C

3. The graph of the circle follows

a. Find the coordinates of the circle's center. Show your work for full credit. (2 points)

a._____

b. Find the radius of the circle. Give the exact answer. (2 points)

b._____

c. Use your answers from parts *a* and *b* to write the standard form of the circle's equation. (2 points)

c._____

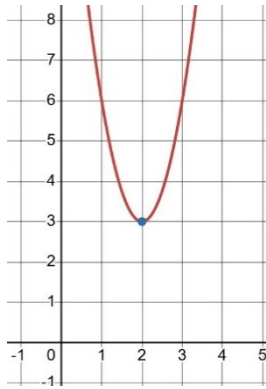4. Write the following equation in standard form. Then give the center and radius of the circle. (5 points)

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

Standard Form _____

Center _____

Radius _____

5. Use the following graph.

a. Identify the vertex. (1 point) _____

b. Using your answer from part a, write an equation in *standard form* of the parabola that has the same shape as the graph of $f(x) = 3x^2$ and has the given vertex above. (3 points)

_____

6. The Detroit Lions season has wound down but we are still thinking about how much we love them! Against the lowly Green Bay Packers, quarterback Jared Goff threw a ball deep to Jahmyr Gibbs. The ball's height in feet, *h(t)*, after *t* seconds is given by $h(t) = -16t^2 + 64t + 6$. Include units in all your answers. Round all answers to the nearest tenth if necessary.

a. What is the <u>height</u> of the football when Jared Goff releases it? HINT: Think about what your *t* value is at this moment. (2 points)

_____

b. <u>When</u> does the football reach it's maximum height? (2 points) _____

c. What is the *maximum* <u>height</u> the football reaches? (2 points) _____

7. A quadratic function is given. (5 points)
$$f(x) = 3x^2 - 12x - 1$$
a. Find the vertex without graphing. Show your work for full credit.

a._____

b. Determine whether the vertex is a maximum or minimum. Circle one. MINIMUM OR MAXIMUM

c. Explain in a sentence how you know the answer to part b given only the equation and not looking at the graph.

_____

_____

Math 120 Test 3C

8. It's Christmas time and Eliza has to keep her tree away from her twin toddlers! Below is an <u>overhead</u> picture of her tree pushed up against the wall and the rectangular 3 sides of fencing she is going to use to   keep them out! All sides are measured in feet. (5 points)

wall

x   x

20 - 2x
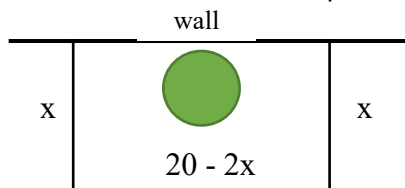
a. Find a function $A(x)$ to express the area of the rectangle as a function of x the width.

_____

b. Find the width that will maximize the area. Include units.   _____

c. What is the largest area that can be enclosed? Include units.   _____

d. Find the length that will maximize the area. Include units.   _____

9. For the following function, find the zeros and give the multiplicity of each. CIRCLE whether the graph will cross at the x-axis OR turn and hit. (3 points)
$$f(x) = 4(x-3)^2(x+5)^3$$

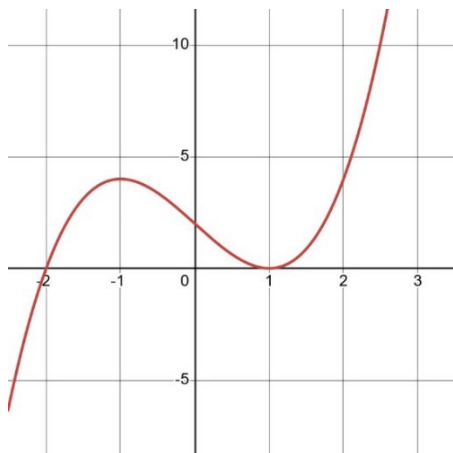Zero _____   multiplicity_____   CROSS   OR   TURN

Zero _____   multiplicity_____   CROSS   OR   TURN

10. A graph of a polynomial function whose zeros are integers is shown.

a. Find the zeros and state whether the multiplicity is even or odd. (2 points)

Zero _____   multiplicity_____

Zero _____   multiplicity_____

b. Write an *equation*, expressed as the product of factors, of a polynomial function that might have this graph. Use a leading coefficient of 1 or -1, and make the degree of f as small as possible. (3 points)

_____

Math 120 Test 3C

11. Use the quadratic function to answer the following questions.

$$f(x) = 3x^2 + 6x + 5$$

a. Use the Leading Coefficient Test to determine the graph's end behaviors. Circle one for each end. (2 points)

LEFT: FALL   or   RISE

RIGHT: FALL   or   RISE

b. Find the zeros. Use exact values and simplify. (3 points)

_____
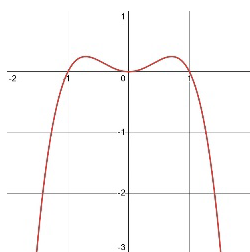
c. Find the y-intercept. (2 points)

_____
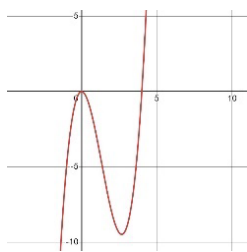
12. Match the information to the graph. Write in A, B, C, or D in the blanks. (4 points)
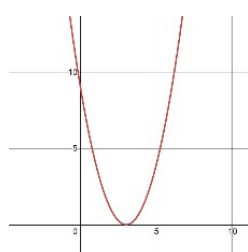
A   B   C   D
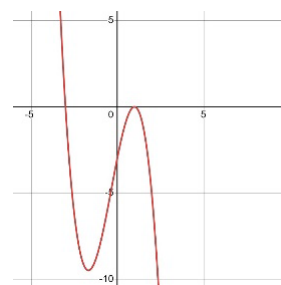

N is odd, a < 0   _____

N is odd, a > 0   _____

N is even, a < 0   _____

N is even, a > 0   _____

13. Write the equation of a polynomial function *f* with the given characteristics. Use a leading coefficient of either 1 or -1 and make the degree as small as possible. (5 points)

zero at $x = -4$ with multiplicity 2, zero at $x = -1$ with multiplicity 1. End-behavior Rise Left, Falls Right

_____

14. Given the graph below, identify and list any asymptotes. (6 points)

_____
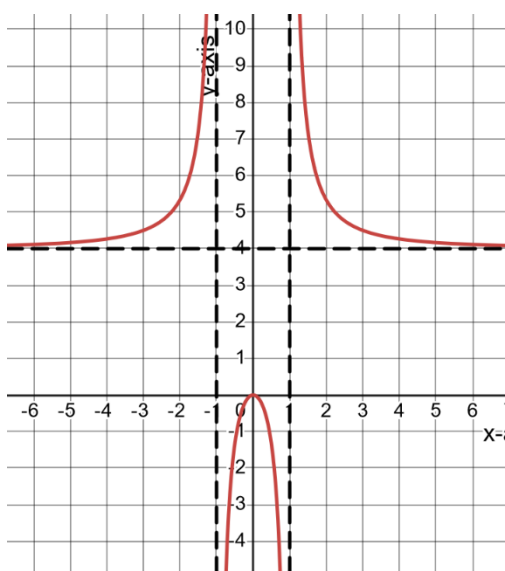
15. Find the domain of the rational function. Answer in interval or set notation. (4 points)

$$f(x) = \frac{x+9}{x^2 - 16}$$

_____

16. The Flash (a superhero with super speed) is tracking his speed for short-distance bursts. The amount of additional Speed S(t), in meters per second, gained each month t of specialized speed training can be modeled by $S(t) = \dfrac{4t}{t^2 + 1}$ $t \geq 0$. This model assumes that the rate of speed improvement per month is proportional to the intensity and consistency of the The Flash's training regimen, represented by the numerator 4t. The denominator $t^2 + 1$ represents potential factors such as biological speed ceilings, training plateaus, or diminishing returns over time as The Flash's body adapts to the stimulus.

a. Explain why $t \geq 0$ in both the equation and the graph in the context of the problem. (2 points)

_____

_____

b. What is the speed gain The Flash has achieved at 3 months? Round to the nearest tenth and include units. (2 points)

_____

c. Find the equation of the horizontal asymptote. In complete sentences, explain its meaning in the context of the problem. (2 points)

_____

_____

_____

17. The equation of a rational function is given.

$$f(x) = \frac{x+6}{x^2 + 5x + 6}$$

a. Find the equation of all vertical asymptote(s), if any. (4 points)   _____

b. Find the equation of the horizontal asymptote, if any. (1 point)   _____

18. C varies jointly as A and T. C = 2100 when A =175 and T =4.

   a. Find k and write the general variation equation showing the relationship between C, A, and T. (2 points)

   _____

   b. Find C when A=240 and T=6. (3 points)

   _____

19. Y varies directly as X and inversely as the square of Z. Y=69 when X=48 and Z=4. Find Y when X=50 and Z=5. (4 points)

   _____

20. When a stone is tied to a string, and whirled in a circle at constant speed, the tension T in the string varies inversely as the radius R of the circle. If the radius is 55 centimeters, the tension is 80 newtons. Find the tension when the radius is 100 centimeters. (5 points)

   _____

Formula Sheet: Math 120

Straight Line

Slope Intercept form

$$y = mx + b$$

Point-slope form

$$y - y_1 = m(x - x_1)$$

Slope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Difference Quotient

$$\frac{f(x+h) - f(x)}{h}$$

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Logarithms

$$\log_b(MN) = \log_b M + \log_b N \qquad \log_b\left(\frac{M}{N}\right) = \log_b M - \log_b N \qquad \log_b M^P = P \log_b M$$

Distance: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint: $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Circle: $(x - h)^2 + (y - k)^2 = r^2$

Quadratic Function

$$f(x) = a(x - h)^2 + k, \text{ Vertex} = (h, k) \qquad f(x) = ax^2 + bx + c, \text{ Vertex} = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$$

Compound Interest: $A = P\left(1 + \frac{r}{n}\right)^{nt}$

Continuous Compound Interest: $A = Pe^{rt}$

Arithmetic Sequence

$$a_n = a_1 + (n-1)d$$

$$s_n = \frac{n}{2}(a_1 + a_n)$$

Geometric Sequence

Finite: $\quad a_n = a_1 r^{n-1} \quad S_n = \frac{a_1(1 - r^n)}{1 - r}, r \neq 1$

Infinite: $\quad s = \frac{a_1}{1 - r}, |r| < 1$

Even function

$$f(-x) = f(x)$$

Odd function

$$f(-x) = -f(x)$$