

MATH 120  
Final Exam  
Summer 2016

**Name:**

**Directions:** Answer the following problems neatly completely. Show all your work and use the appropriate notation. You are **not** allowed to use any kind of calculator. **No solution, no credit.** Good luck.

1. Katrina wants to divide  $5x^3 - 9x^2 - 20x + 9$  by  $x + 3$  using synthetic division. Her friend, Libby, claims that she cannot use synthetic division for this problem. Is Libby correct? If yes, explain why; otherwise, perform the synthetic division and clearly identify the answer.

2. Matthew is trying to graph the rational function  $h(x) = \frac{2x^2 - 5x + 1}{x + 1}$ . He needs help finding the asymptotes. Find the asymptotes of the graph of  $h(x)$ . Do **NOT** draw the graph.

3. George is given the function  $h(x) = 3x^2 - 12x + 5$  and he is trying to visualize the graph. He thinks that the graph should be a parabola. Is George correct? If yes, then determine the vertex of the parabola; otherwise, explain why it is not a parabola. Do **NOT** draw the graph.

4. Find the equation of the circle that is centered at the point  $(-2, 3)$  and has diameter 7.

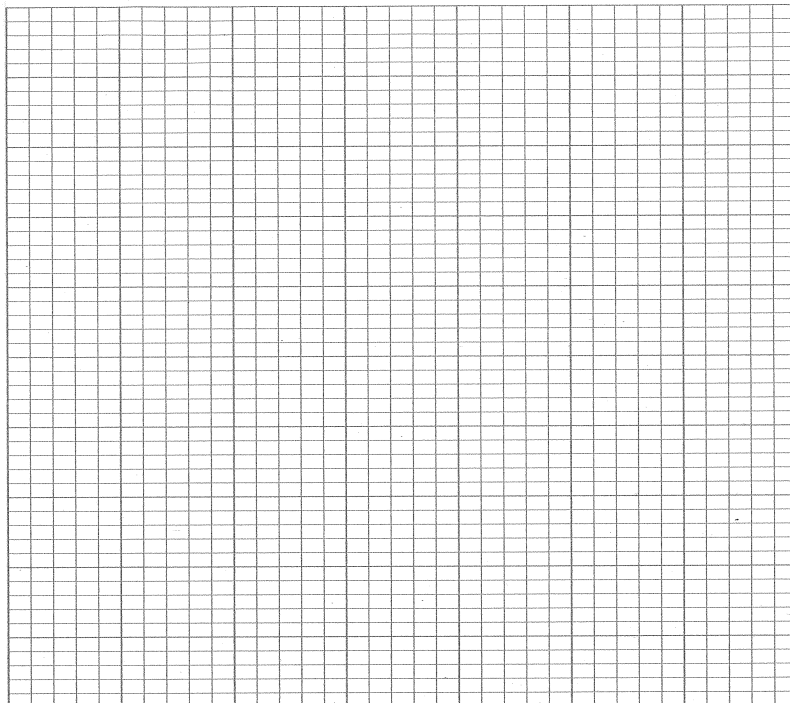
5. Find the zeros of the following functions and express them in the simplest form possible. If the zero is a complex number, you need to write your answer in the form  $z = a + bi$ .

(a)  $f(x) = 2x^3 - x^2 + 8x - 4$

(b)  $g(x) = x^2 + 10x + 17$

(c)  $G(x) = \frac{x^2 - 4x}{x^2 + 4x} - 2$

6. Graph  $g(x) = -\sqrt{x-4} + 2$ . Make sure to identify the parent function and clearly indicate on the graph the reference points that you used.



7. Find the values of  $x$  that will satisfy the following inequalities. Write your answer in interval notation.

(a)  $3x + 4 \geq 6x - 5$

(b)  $\frac{x+2}{x-3} > 0$

(c)  $|x+4| < 8$

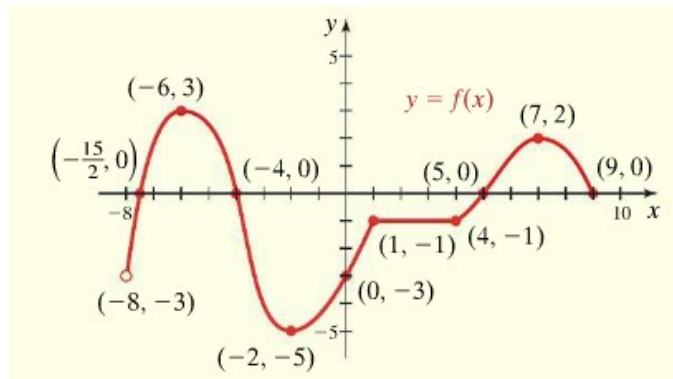
8. Solve the following systems of equations. For (a) and (b), use any method. For (c), use Cramer's Rule.

$$(a) \quad \begin{aligned} 2x - 3y &= -3 \\ 6x - 9y &= -4 \end{aligned}$$

$$(b) \quad \begin{aligned} 3x + 4y - 2 &= 0 \\ 5x - 3y + 16 &= 0 \end{aligned}$$

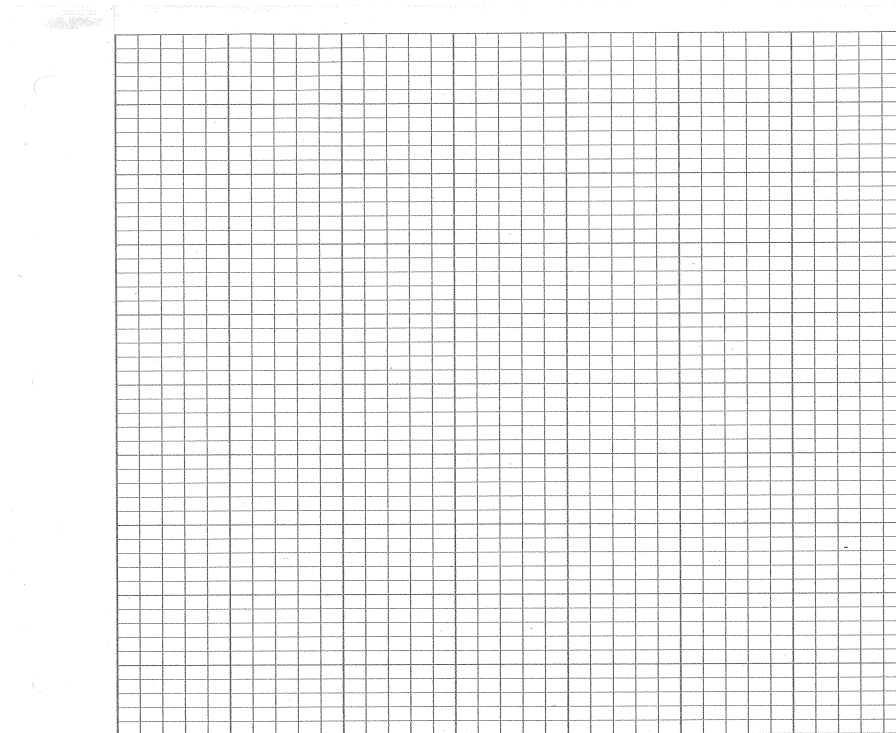
$$(c) \quad \begin{aligned} \text{(Use Cramer's Rule)} \quad .3x - .1y &= -1.1 \\ .2x + .3y &= 1.1 \end{aligned}$$

9. Consider the function  $f$  whose graph is given below.



- Determine the domain of  $f$ .
- Determine the range of  $f$ .
- What is  $f(2)$ ?
- Is the function  $f$  odd, even, or neither? Justify your answer.
- Determine the interval(s) where the function  $f$  is increasing.
- Is the function one-to-one? Justify your answer.

10. Graph the function  $h(x) = x^3 - 2x^2 - 5x + 6$ . Show all the necessary steps. Merely plotting points will not give you much credit.





11. Consider the functions  $f(x) = 2x - 9$  and  $g(x) = x^2$ . Perform the indicated operations and simplify. State the domain of the resulting function.

(a)  $\left(\frac{g}{f}\right)(x)$

(b)  $(fg)(x)$

(c)  $(g \circ f)(x)$

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

12. Find the equation of the line that is perpendicular to the line  $3y = 2x + 4$  and passes through the point  $(-2, 4)$ . Write your equation in slope-intercept form.

13. Ava wants to enclose a rectangular play area that is 6 feet longer than it is wide. Her dad gave her 62 feet of fencing material. If Ava wants to use all the fencing material, what should be the dimensions of the play area? Write an equation to model the problem and express your answer in the simplest form possible with the appropriate unit of measure.

14. Consider the matrices  $A = \begin{bmatrix} 2 & 0 \\ 3 & 2 \\ 0 & 1 \end{bmatrix}$ ,  $B = \begin{bmatrix} -1 & 2 & -3 \\ 0 & 3 & -1 \\ 1 & 3 & 2 \end{bmatrix}$ , and  $C = \begin{bmatrix} 1 & -1 & 2 \\ 2 & 0 & -1 \end{bmatrix}$ .

Perform the indicated operations. If it is not possible to perform the operation, explain why.

(a)  $AB$

(b)  $AC$

(c)  $\det(B)$  [Clearly indicate which row or column you are using for your expansion.]