

MATH 3: Midterm 1, Version 2, Fall 2015

Name: _____

Calculators are not allowed.

Quickly read all the questions before you start working on any of them. Start with the ones you are most comfortable with, and continue with the other ones later. Always double-check your answers.

Relax, and do your best!

PROBLEM 1: SHORT QUESTIONS [60 POINTS] In the following questions, you are merely asked to provide the answer. No justification is needed. You should not be spending more than a 2 minutes per question. Each question is worth 3 points.

1. Find the linear function $f(x)$ such that $f(0) = 2$ and $f(1) = 0$. ?

2. What is the discriminant of the following quadratic function? $f(x) = cx^2 - ax + b$?

$D =$ _____

Given the functions $f(x) = \frac{1}{x-3}$ and $g(x) = \sqrt{x+1}$

3. Write down, and then simplify the expression $f(x) - f(x+3)$.

4. What is the domain of $f(x)$? _____

5. What is the domain of $g(x)$? _____

6. What is the domain of $\frac{f}{g}(x)$? _____

7.,8. Sketch the function $f(x) = -(x + 2)^3 + 1$ and $g(x) = \frac{1}{(x-3)^2} + 3$

Given the function $f(x) = -x^2 + 4x + 1$ and its graph:

9. Complete the square

10. What are the coordinates of the vertex? -----

11. Does it open up or down? -----

12. What is the equation of the tangent at the y -intercept? -----

13. Does the function have roots? If so, what are they? Hint: $\sqrt{5} \simeq 2.2$.

14. Based on this information, sketch the parabola $y = -x^2 + 4x + 1$, making sure to annotate your graph correctly.

15. Factor the quadratic function $f(x) = 3x^2 + 2x - 1$ using the quadratic formula

16. Factor the following expression by grouping, and make sure your result is *fully* factored:
 $f(x) = x^4 + 3x^3 - x^2 - 3x$.

Given the function $f(x) = \frac{x^2-4}{x-3}$:

17. What is the name of this type of function? -----

18. What are the x -intercepts? -----

19. What is the vertical asymptote? -----

20. What is the equation of the oblique asymptote? -----

PROBLEM 2. [20 POINTS] Consider the function $f(x) = -x^3 + 9x$.

(a) Behavior for large x :

- What is $f(x)$ approximately equal to for large $|x|$? -----
- When x tends to $-\infty$, $f(x)$ goes to -----
- When x tends to $+\infty$, $f(x)$ goes to -----

(b) Is the function odd or even? -----

(c) Factor $f(x)$

(d) Determine the x - and y - intercepts

x -intercept(s): ----- y -intercept: -----

(d) Draw a signs table (make sure to include the zeros)

(e) Sketch the function $f(x)$

PROBLEM 3. APPLIED PROBLEM [20 POINTS].

This problem guides you through the calculation of the optimal sales price for a new smartphone. Market analysis shows that the likely number of phones N that would sell in the US every day is a linear function of the sales price, which we call x :

$$N(x) = -20x + 8000$$

Question 1: How many phones would be sold (per day) if the price was \$100 per phone ?

Question 2: Let the revenue R be the amount of money made when selling N phones. What is the revenue (per day) as a function of the price x ?

Question 3: What is the name of this type of function? -----

Question 4: Factor $R(x)$ and draw its signs table. Use the table to sketch $R(x)$.

Question 5: What is the position of the maximum of $R(x)$?

Question 6: What is price they should sell their phones to make as much money as possible? -----

Question 7: Above what price would they start losing money? -----