MATH 3: Midterm 1, Version 1, 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 $f(0) = 1$ and $f(1) = 0$. ?

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

$D =$_____

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

3. Write down, and then simplify the expression $f(x) - f(x-1)$.

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 $f(x) = -(x-1)^3 + 2$ and $g(x) = \frac{1}{(x+1)^2} - 1$

Given the function $f(x) = -x^2 - 4x - 2$ 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: $\sqrt{2} \simeq 1.4$.

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

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

16. Factor the following expression by grouping, and make sure your result is *fully* factored:
$f(x) = x^4 + 2x^3 - 4x^2 - 8x$.

Given the function $f(x) = \frac{x^2-1}{x+5}$:

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 $f(x) = x^4 - 4x^2$.

(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: _____

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

(f) 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 HP tablet. Market analysis shows that the likely number of tablet N that would sell in the US every day is a linear function of the sales price, which we call x:

$$N(x) = -2x + 4000$$

Question 1: How many tablets would be sold (per day) if the price was $500 per tablet ?

Question 2: Let the revenue R be the amount of money made when selling N tablets. 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 HP should set their tablets at to make as much money as possible? _____

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