

**REVIEW.** This review meant to give you some direction while beginning to prepare for the final exam on December 12. It can act as a starting point for your studying. The test will not be limited to these problems as any type of problem that we have covered this semester is a viable test question. You must know definitions, identities, rules, algorithms, and theorems in the chapters. There is also a separate review and practice problems posted on your internet homework page. The final exam does cover the entire semester's material. I have arranged the material on the review into quarters depending on when it was covered in the course. The material under Fourth Quarter is the material that has not been tested yet.

#### Fourth Quarter

- If  $f(x) = 5x^3 - 3x^2 + 5x + 4$  then  $f(8) = 2412$ . What is the tangent line approximation to  $f(x)$  at  $x = 8$ ? Determine a value of  $x$  near 8 such that  $L(x) = 2362$ .
- If  $x$  is written as  $((x - 5) + 5)$  and in this form  $x^7$  is expanded, what are the all the coefficients of the polynomial using  $(x - 5)$  as your variable?
- What is the sum of the 19th row of Pascal's triangle?
- If  $(5r - 2t)^9$  is expanded out then the coefficients of  $r^7t^2$  is what?
- The radius of a circle is 32 cm. If starting at a point A on the circle you go 51.367 cm around the circle and call the ending point B, then the length of the chord AB is what?
- At an unknown distance from its base the top of a tower subtends an angle which measures 57.456 degrees. From a distance 844 feet farther away from the tower base the subtended angle measures 40.358 degrees. To within five feet, the tower is how tall?
- The tangent line to the graph of  $f(x) = -x^2 - 5x - 96$  at  $x = 4$  meets the x-axis at the point U. What are the angles above the x-axis that the tangent line creates with the x-axis?

#### Third Quarter

- Let  $g(x) = x^3 + 8x^2 - 45x - 150$ . If  $p$ ,  $q$ , and  $r$  are real roots of  $g(x)$  where  $p = 5$  and  $q = -3$  then what does  $r$  equal?
- A quadratic  $Q(x) = ax^2 + bx + c$  has extrema at  $(-3, 6)$  and a root at  $x=2$ . What is the quadratic?
- What is the equation of the tangent line to  $y = 4x^2 + 2x - 4$  at the points  $x = -1, 3, 0$ ?

- For what intervals is the function  $h(x) = -2x^2 - 2x + 17$  positive and negative?
- A mail order store charges a flat shipping charge of \$11 for purchases of up to \$50. For each additional \$10 the shipping charge increases by \$2 however the shipping charge becomes zero after a purchase of more than \$150. What is the shipping charge of a \$119 purchase and what is the maximum shipping charge? (hint: try to graph it, maximum implies part of the graph is not linear)
- What is the equation of the tangent line to the graph  $x^2 - 2x + 144 - 3y^2 + 24y = 0$  at the point  $(1, 3)$ ?
- Determine all intercepts and extrema of the following functions:
  - $y = -2x^2 + 5x - 24$
  - $f(x) = x^2 + 3x + 1$
  - $g(x) + 2 = 2(x - 1)$
  - $h(x) = -4x^2 + 3x - 100$
- Calculate the derivatives of the following functions:
  - $f(x) = 2x^2 - 6x + 1$
  - $g(x) = x^{-5} - 3x - 1$
  - $h(x) = -3x + 4$
  - $y = \sqrt{(x - 5)(x + 2)}$
- Model a function that goes through the following points  $P(-4, 5)$ ,  $Q(2, 6)$ ,  $A(8, -15)$ .

#### Second Quarter

- Consider the parametric line  $x = 2t - 7$ ,  $y = -5t + 4$ . Determine the slope intercept form of the same line.
- What is the centre and radius of the circle with equation  $x^2 + y^2 - 3x + 12y = 8$ ?
- The sin of the angle that the line  $y = 3x$  makes with the positive x axis is?
- Find the points of intersection of the two circles:

$$x^2 - 3x + 1 + y^2 - 4y = 9 \text{ and } x^2 + 8x + 21 + y^2 - 8y = 4.$$

- Given a line  $L : 4x + 5y = 3$  and a point  $P(-1, 5)$ , what is the equation of the line  $M$  passing through  $P$  and perpendicular to  $L$ ? What is the equation of the line passing through the origin and parallel to  $L$ ?

- Assume that you are given a coordinate change in the plane which changes coordinates  $(x, y)$  to new coordinates  $(z, w)$  given by the formula:  $z = Ux + P$  and  $w = Vy + Q$  where  $U, V = \pm 1$  and  $P, Q$  are real numbers.

If the new coordinates of the point  $(1, -1)$  become  $(4, -4)$  and the new coordinates of  $(5, -3)$  become  $(2, -2)$ , then what are the exact values for  $U, V, P,$  and  $Q$ ?

- Find the equation of the circle which is centered at  $(4, -2)$  and which is tangent to the line  $-7x + 2y + 5 = 0$ .
- What is the exact distance from  $A(-7, -2)$  and  $B(1, 6)$ ? What are the possible points  $P(3, y)$  such that the distance from  $P$  to  $B$  is 7?
- If  $s$  and  $t$  are both odd or both even integers then the triple

$$\frac{1}{2}s^2 - \frac{1}{2}t^2, st, \frac{1}{2}s^2 + \frac{1}{2}t^2$$

is a Pythagorean triple. The triple that corresponds to  $s = 7, t = 5$  is?

- What is the distance from the line  $y = 2x - 4$  to the point  $P(-3, 7)$ ?
- For which values of  $t$  is the triangle with vertices  $(8, -3), (2, 6), (-5, t)$  a right triangle?
- Find the equation of the circle containing the points:

$$A(3, -1), B(-2, 0), C(-2, -3).$$

- A coordinate system is set up in a plane and Jason starts at the origin. He first walks 3 miles east and 2 miles south to go to his invigorating MA109 class on Monday night. After class he catches the bus and goes 15 miles west and 11 miles north to the grocery store to pick up deodorant and shampoo. He then walks 1 mile west and 3 miles south to meet his best friend Larry for beers at the bar. Finally he catches a cab home which takes him 5 miles west and 9 miles south. At what position  $N, S, E, W$  did Jason end up?
- Given three lines:

$$-2y - 6x + 4 = 0$$

$$-2y - 3x + 2 = 0$$

$$2y - 7x + 2 = 0$$

Determine all of the vertices of the triangle formed by these three lines.

- If  $A(1, 4)$  and  $B(-3, -7)$  mark the endpoints of the diameter of a circle  $C$  then the equation of circle  $C$  is?

First Quarter

- If  $f(x) = x^4 + 2x^2 - 4x + 2$  and  $g(x) = 2x^3 + 6x^7 - 4x - 3$  then what is the degree and leading coefficient of  $f(x)$ ,  $g(x)$ ,  $f(x) + \frac{7}{8}g(x)$  and  $f(x) * g(x)$ ?
- Expand  $(x + t)^7$ .
- If  $f(x) = 2x^2 - 4x - 3$  and  $g(x) = x + 2$  then what is  $f(g(x))$ ?
- If  $(x + d)$  is substituted for  $x$  in  $4x^2 + 2x - 4$  and the resulting coefficient of the  $x$ -term is 0, then  $d =$ ?
- What is the degree and coefficient of  $5x^3y^4$ ? What if we consider it with only  $y$  as a variable?
- If  $(x - 4)$  is substituted in for  $x$  into  $(x-1)(x+7)$  then what is the expanded form of your result?
- By itself the cold water faucet can fill a tub in 9 minutes while by itself the hot water faucet can fill the same tub in 5 minutes. Together the two faucets can fill the tub in how many minutes?
- Solve the following system of equations by using Cramer's Rule:

$$\begin{cases} 5x - 4y = -5 \\ 3x + 7y = 5 \end{cases}$$

- Are the following equations consistent, or inconsistent? If consistent then give the valid solutions.
  - $\{5t + 12 = 15t + 21, 27t + 25 = 12t + 10\}$
  - $\{-5v + 3 = -15v + 5, -24v + 5 = -9v + 2\}$
- What is the determinant of the matrix

$$\begin{pmatrix} -5 & 2 \\ -4 & -13 \end{pmatrix}?$$

- Find the GCD and LCM of the following:
  - 63144 and 8352
  - 1723 and 981

Then write the GCD of each pair of numbers as a linear combination of each number.

- Write the monic GCD of  $-12 + x^2 + 2x + 2x^3$  and  $3 + 4x - 4x^2$  as a combination of both polynomials.
- If  $f(x) = x^5 + 4x^4 - 7x^2 + 2x^3 - 15$  then  $f(\sqrt{6}) = (\text{-----})\sqrt{6} + ?$