

MATH 140. TEST 2 (HARVEY - FALL 2003).

1. (8 points) Give the coordinates of the vertex of the parabola:

$$y = x^2 + 3x + 5$$

2. (8 points) For large values of  $|x|$ , the polynomial  $p(x) = (2x + 1)^2(x - 3)^3(3x + 2)$  begins to closely resemble a function  $y = ax^n$ . What are  $a$  and  $n$ ?

3. (8 points) Let  $p(x) = (3x + 1)^3(2x - 1)(x + 5)^2$ . List all the zeros of  $p(x)$  and their multiplicities.

4. (8 points) Divide:

$$\frac{3x^4 + 5x^3 + 25x^2 + 45x - 18}{x^2 + 9}$$

7. (8 points) Let

$$p(x) = x^3 - 2x^2 + x + 1$$

According to Descartes' rule of signs, how many positive real zeros can  $p(x)$  have? How many negative real zeros can  $p(x)$  have?

8. (12 points) Find all real zeros of  $p(x) = x^3 - x^2 + 13x + 15$ .

9. (12 points) Find all real zeros of  $p(x) = x^4 - 2x^3 - 13x^2 - 4x - 30$ .

10. (10 points) List the equations of all asymptotes, and give the coordinates of all intercepts of the rational function

$$R(x) = \frac{2x}{x^2 + 3x + 2}$$

11. (10 points) List the equations of all asymptotes, and give the coordinates of all intercepts of the rational function

$$R(x) = \frac{x^2 + 5x + 4}{x - 1}$$

12. (8 points) The volume  $V$  of a sphere varies directly as the radius  $r$  cubed of the sphere. When  $r = 3$ ,  $V = 36\pi$ . Find the equation of the volume of the sphere in terms of the radius.



