Practice Test- Critical Points, Derivatives, Rational Functions

1. Find the extrema of $f(x) = x^7 - 3x^2 + x + 5$ using a calculator. You do NOT need to show work, but you do need to indicate the method used (trace function, table, or min/max function).

2. The function $f(x) = -x^3 - 6x^2 - 12x - 7$ has a critical point when x = -2. Identify the point as a maximum, a minimum, or a point of inflection, and state its coordinates.

3. Suppose that during an experiment you launch a toy rocket straight upward from a height of 6 inches with an initial velocity of 32 feet per second. The height at any time *t* can be modeled by the function $s(t) = -16t^2 + 32t + 0.5$ where *s*(*t*) is measured in feet and *t* is measured in seconds. Use the derivative to find the maximum height obtained by the rocket before it begins to fall.

4. Find derivative of f(x) = $2x^2 + 5x$ ***using the definition of the derivative***.

5. Find derivative of the following.

a. $f(x) = 5x^3 - 2x^2 - x + 3$ b. f(x) = (2x + 7)(3x - 8)

6. Acceleration is the rate at which the velocity of a moving object changes. The velocity in meters per second of a particle moving along a straight line is given by the function $v(t) = 3t^2 - 6t + 5$ where *t* is the time in seconds. Find the acceleration of the particle in meters per second squared after 5 seconds. (*Hint:* Acceleration is the derivative of velocity.)

7. Graph by hand: a. $y = \frac{3}{x+1} - 2$ b. $y = \frac{1}{x-3} + 4$

8. Identify discontinuities of rational functions (holes, vertical asymptote, horizontal asymptote).

a. $f(x) = \frac{(x-1)(x+4)}{x(x-2)(x+4)}$ b. $f(x) = \frac{(x+1)(-7x+5)}{(x-1)(3x-2)}$

Answer key:

1. relative maximum at (.167, 5.08), relative minimum (.93, 3.94)

2. point of inflection at (-2, 1) 3. 16.5 feet 4. f'(x) = 4x+5

5. a. $f'(x) = 15x^2 - 4x - 1$ b. f'(x) = 12x + 5 6. 24 m/s^2

7. Graphs

8. a. hole at -4, vertical asymptote at x = 2 and x = 0; horizontal asymptote at y = 0

b. no hole, vertical asymptote at x = 2/3, horizontal asymptote is y = -7/3