Take Home: Polynomial and Radical Functions

Name:

Due November 25, 2013

When applicable, answer to two decimal places.

1. For the following polynomial: $f(x) = (x-1)(x+5)(x-2)^3$

   (a) What is the degree of the polynomial?

   (b) What is the leading coefficient?

   (c) Fill in the table:

x value of factor					
multiplicity					

   (d) What are the (x, y) values of its relative minima?

   (e) What are the (x, y) values of its relative maxima?

   (f) Does it have an absolute minimum? If so, what is the (x, y) value of it?

   (g) Does it have an absolute maximum? If so, what is the (x, y) value of it?

   (h) What happens to the function as x approaches negative infinity?

   (i) What happens to the function as x approaches positive infinity?

   (j) On a separate sheet of paper, graph the function. Clearly label axes, relative minima, relative maxima, and zeroes.

2. For the following rational function: $g(x) = \frac{x}{x^2-x-6}$

   (a) What are its vertical asymptotes?

   (b) What, if any, are its horizontal asymptotes?

   (c) What, if any, are its holes?

   (d) Sketch its graph. Clearly label axes, asymptotes, and holes.

3. A company making toys estimates the amount of money they spend each day to be

$$C(x) = 0.0002x^3 - 0.01x^2 - 10x + 2500$$

   where x is the number of toys they make each day.

   (a) Write a function $A(x)$ describing the average cost of the toys they make.

   (b) Sketch the graph of $A(x)$ for positive values of x and $A(x)$. Clearly label any asymptotes.

   (c) What is $A(100)$? $A(300)$?

   (d) What, if any, are its horizontal asymptotes? What does this asymptote say about the company's costs?

4. Newton's Law of Universal Gravitation states that there is a gravitational force between any two masses that is equal in magnitude for each mass, and is aligned to draw the two masses toward each other. This is the relationship presented as a function:

$$F(r) = G\frac{m_1 m_2}{r^2}$$

   where F is the force, m_1 and m_2 are the masses of the two bodies, and r is the distance between them. The Earth is 5.97×10^{24}kg and the Moon is 7.35×10^{22}kg; the distance between the Earth and Moon is 3.84×10^8m; and the force is 2.02×10^{20}N.

   (a) How would you describe the relationship between F and r?

   (b) Use these figures to calculate G, the universal gravitation constant.