1. Determine whether the statement is true or false. If the statement is false explain why.

   a) If the f has an absolute maximum value at z, then the $f'(z) > 0$

   (TRUE / FALSE)

   SOLUTION FALSE because at either maximum or minima then $f'(z) = 0$ or be undefined or its on the interior of the domain.

   b) The function $f(x) = 2x(x+4)^3$ has inflection points at: (0,0) and (4,0)

   (TRUE / FALSE)

   SOLUTION FALSE because the inflection point is at (-4,0) (-2, -32)

2. Find two negative numbers that add up to -50 whos product is large as possible.
   SOLUTION $x_1 = -25 \& x_2 = -25$

3. Find the local extrema and the intervals where the following function is increasing or decreasing: $f(x) = x^{\frac{2}{3}}(x - 10)$
   SOLUTION Local max at x = 0, local min at x = 4, increasing $(-\infty, 0) \cup (4, \infty)$, decreasing (0,4)

4. A piano is suspended by a 90 ft rope through a pulley system that is vertically 40 ft above a man's arm. The piano is at some height above the ground. At t = 0, the man is 30 ft horizontally from the piano and walks away at 12 ft/s. How fast is the piano being pulled up?
   SOLUTION 36/5 ft/s

5. Determine the critical numbers of the following functions:

   a)
   $$V(t) = 1 + 80t^3 + 5t^4 - 2t^5$$
   SOLUTION t = 0, -4, 6

   b)
   $$Q(t) = (2 - 8x)^4(x^2 - 9)^3$$
   SOLUTION t = $\frac{1}{4}$, t = 3, t = -3, t =

6. Use linear approximation to find the approximate value of sin(122°)
   HINT Re-express degrees in terms of radians by using 120°
   SOLUTION
   $\frac{\sqrt{3}}{2} + (-\frac{1}{2})(\frac{\pi}{90})$

7. For the following functions answer each of the following

   - identify the critical points of the function and classify them as local maximum, local minimum, or neither
   - identify the intervals on which the function is increasing/decreasing
   - determine the interval on which the function is concave up or down
   - determine the inflection points of the function
   - use the information found to sketch the graph of the function

   a)
   $$g(t) = t^5 - 5t^4 + 8$$

   SOLUTION CRITICAL POINT:$t = 0$ and $t = 4$
   CLASSIFICATION OF CRITICAL POINTS:
   RELATIVE MINIMUM: 4
   RELATIVE MAXIMUM: 0
   INCREASING: $(-\infty, 0) \cup (4, \infty)$
   DECREASING: $(0, 4)$
   CONCAVE UP: $(3, \infty)$
   CONCAVE DOWN:$(-\infty, 0)$ & $(0, 3)$
   INFLECTION POINT: $t = 3$

   b)
   $$x^{4/3}(x - 2)$$

8. A car is heading "away" from the intersection at 5 m/s. And a bus is heading "towards" the intersection on the other street (at a right angle) at 4 m/s. How fast is the distance changing when the car is is 30 m away from the intersection and the bus is 40 m from the intersection? Additionally, is the distance increasing or decreasing?
   SOLUTION
   distance is changing at $-\frac{2}{10}$ m/s
   The distance is decreasing.

9. Find the horizontal asymptote(s) of the following functions:

   a)
   $$\frac{8-4x^2}{9x^2+5x}$$
   SOLUTION $-\frac{4}{9}$

   b)
   $$\frac{\sqrt{7+9x^2}}{1-2x}$$
   SOLUTION $x \to -\infty : y = -\frac{3}{2}$
   $x \to \infty : y = \frac{3}{2}$

10. Compute the differential dy of the following functions:

   a)
   $$f(x) = x^2 - \sec(x)$$
   SOLUTION $df = (2x - \sec(x)\tan(x))\,dx$

   b) Compute the dy and $\triangle y$ for $y = x^5 - 2x^3 + 7x$ as x changes from 6 to 5.9
   SOLUTION$dy = (5x^4 - 6x^2 + 7)\,dx$ and -627.1

11. Multiple Choice. Read each question and answer choice carefully and choose the ONE best answer.

   a) A right cylindrical cone has a radius of 4 cm and a height of 2.0 cm. If the height increases at 0.5 cm/min, but the radius remains constant, then what will be the rate of change of the volume?

      A) 8.4 cm^3/min
      B) 1.1 cm^3/min
      C) 4.2 cm^3/min
      D) 2.1 cm^3/min

   SOLUTION A)8.4

b) Given that the cost function $C(x) = 144 + 0.1x + 0.04x^2$, what is the minimum average cost per unit?

A) 20 dollars
B) 40 dollars
C) 60 dollars
D) 80 dollars

SOLUTION C) 60 dollars

c) Find the approximate value of $(5.2)^3$ using linear approximation using x = 5

A) 130
B) 140
C) 150
D) 160

SOLUTION [B] 140

12. Determine the number(s) c that satisfies the conclusion of the Mean Value Theorem for the given function and interval.

$$f(z) = 4z^3 - 8z^2 + 7z - 2$$

on the interval [2,5]
SOLUTION $c = \frac{2+\sqrt{79}}{3}$

13. Answer the following questions with the given graph:

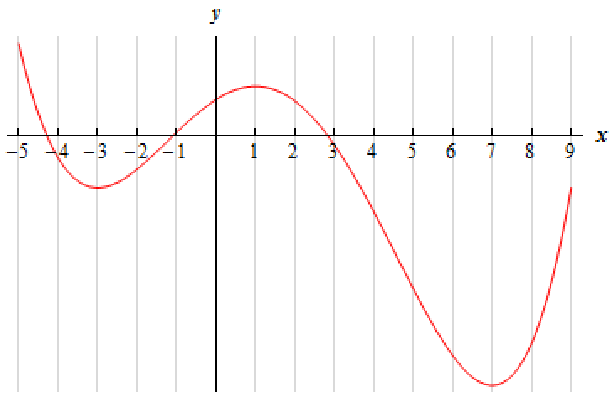

Figure 1: graph of f(x)

a) Write down the interval in which the graph is increasing:

b) Write down the interval in which the function is decreasing:
SOLUTIONIncreasing from (-3,1) $(7, \infty)$ Decreasing from $(-\infty, -3)$ (1,7)

14. Use Newton's method to determine x_2 for $f(x) = x^3 - 7x^2 + 8x - 3$ if $x_0 = 5$
SOLUTION $3x^2 - 14x + 8$

15. Sketch a graph with the following information:

$$f(4) = 0, f'(2) = 0, f"(4) = 0 \lim_{x\to\infty} f(x) = 1 \lim_{x\to-\infty} = -\infty$$

Vertical Asymptote at x = 0, $f'(x) > 0$ for $x < 0 \quad x > 2$
$f'(x) < 0$ for $0 < x < 2$
$f''(x) > 0$ for $x < 0$ and for $0 < x < 4$; $f''(x) < 0$ for $x > 4$.