

1. **10 pts** 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)

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

(TRUE / FALSE)

2. **5 pts** Find two negative numbers that add up to -50 whos product is large as possible.

3. **5 pts** Find the local extrema and the intervals where the following function is increasing or decreasing: $f(x) = x^{\frac{2}{3}}(x - 10)$

4. **10 pts** 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?

5. **10 pts** Determine the critical numbers of the following functions:

a)

$$V(t) = 1 + 80t^3 + 5t^4 - 2t^5$$

b)

$$Q(t) = (2 - 8x)^4(x^2 - 9)^3$$

6. **10 pts** Use linear approximation to find the approximate value of $\sin(122^\circ)$
HINT Rexpress degrees in terms of radian by using 120°

7. **20 pts** 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)

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

b)

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

8. **10 pts** 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 30 m away from the intersection and the bus is 40 m from the intersection? Additionally, is the distance increasing or decreasing?

9. **10 pts** Find the horizontal asymptote(s) of the following functions:

a)

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

b)

$$\frac{\sqrt{7 + 9x^2}}{1 - 2x}$$

10. **10 pts** Compute the differential dy of the following functions:

a)

$$f(x) = x^2 - \sec(x)$$

b) Compute the dy and Δy for $y = x^5 - 2x^3 + 7x$ as x changes from 6 to 5.9

11. **15 pts** 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) $8.4 \text{ cm}^3/\text{min}$
- B) $1.1 \text{ cm}^3/\text{min}$
- C) $4.2 \text{ cm}^3/\text{min}$
- D) $2.1 \text{ cm}^3/\text{min}$

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

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

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

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