

# Math 2143 - Brief Calculus with Applications

Exam #3 - 2021.04.23

Name: \_\_\_\_\_

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1. Consider the function  $G(x) = x^3 + 3x^2 - 12$ .

(a) Compute  $G'(x)$ .

(b) Find the critical points of  $G(x)$ .

(c) State the intervals of increase and decrease for  $G(x)$ .

(d) Classify the critical points from part (b) using the First Derivative Test.

(e) State the intervals of concavity  $G(x)$ .

(f) Locate any inflection points of  $G(x)$ .

(g) Classify the critical points from part (b) using the Second Derivative Test.

(h) Find the absolute maximum and minimum values of  $G(x)$  on the interval  $[-3, 1]$ .

2. Consider the function  $F(x) = \frac{(2x+1)^2}{(x-1)(x+2)}$ .

(a) State the domain of  $F(x)$ .

(b) Locate the roots of  $F(x)$ .

(c) Locate the vertical asymptotes.

(d) Locate (if any) horizontal or slant asymptotes.

(e) Find the  $y$ -intercept.

(f) Compute the limits at the vertical asymptotes.

(g) Sketch the graph of  $F(x)$  using the information from parts (a)–(f).

3. Upon inspection, determine the slant asymptote of the function  $R(x) = \frac{6x^5 - 3x^4 + 2x^2 + 1}{3x^4 + 4x^3 + 8x^2 + 2x}$

4. Find  $\frac{dy}{dx}$  by implicit differentiation if  $3x^2 + 4xy^2 = \ln(2x + 1) + 6$ .

5. Use logarithmic differentiation to compute the derivative of the following function:

$$T(x) = \frac{(3x + 1)(5x - 7)^3(2 - 6x)^{3/2}}{\sqrt{8x + 1}(4x^2 + 7)}$$

6. In an attempt to do well on this exam, you attempt to offer up the instructor as a sacrifice to the Gods. To do so, the instructor is bled out and his blood pools on the floor. The blood leaves the instructor's body at constant rate of  $3 \text{ cm}^3/\text{sec}$  and pools in a perfect disk shape 1 cm thick (naturally of course). The volume of a disk of radius  $r$  and height  $h$  is  $V = \pi r^2 h$ . At what rate is the radius of the pool of blood growing when the disk is 4 cm in radius?