

Math 2143 - Brief Calculus with Applications

Exam #3 - 2021.04.23

Name: _____

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?