

Directions: Complete each of the following NEATLY IN PENCIL in the space provided. Show all work; round at THREE decimal places. Good Luck.

Multiple Choice (3 pts. each)

1. Give the approximate location of a local maximum for the function $y = 5x^3 - 7x^2 + 2x - 1$.

- (a) (0.176, -1.328)
 (b) (0.757, -0.838)
 (c) (0.176, -0.838)
 (d) (0.757, -1.328)
 (e) (-0.838, 0.176)

Graph on calculator between (-1, 1)
 and find the max

2. Given $f(3) = 5$, $f'(3) = 1.1$, $g(3) = -4$, and $g'(3) = 0.7$, find the derivative of $\left(\frac{f}{g}\right)$ at $x = 3$

- (a) 0.025
 (b) 0.49375
 (c) -0.49375
 (d) -0.025
 (e) 1.975

$$\frac{f'g - g'f}{g^2} = \frac{(1.1)(-4) - (0.7)(5)}{(-4)^2} =$$

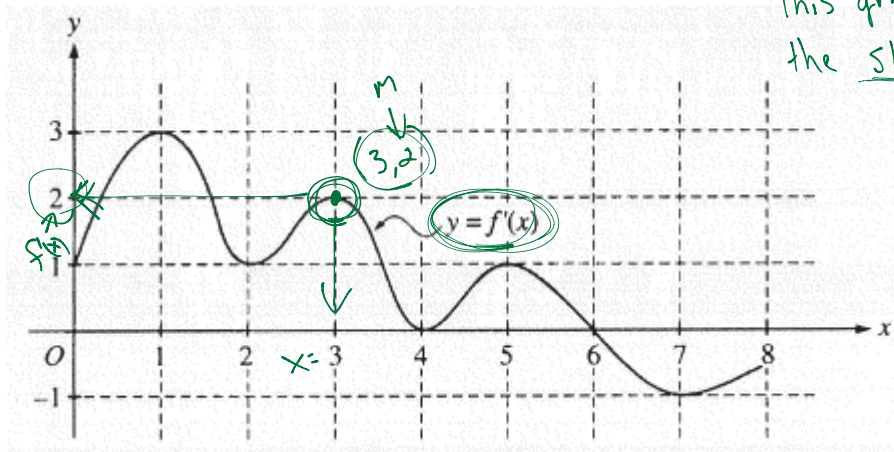
3. $\lim_{x \rightarrow 1} \frac{\sqrt{x+3} - 2}{1-x} = \frac{\sqrt{1+3} - 2}{1-1} = \frac{2-2}{1-1} = \frac{0}{0}$

- (a) 0.5
 (b) 0.25
 (c) 0
 (d) -0.25
 (e) -0.5

$$\lim_{x \rightarrow 1} \frac{\sqrt{x+3} - 2}{1-x} \cdot \frac{(\sqrt{x+3} + 2)}{(\sqrt{x+3} + 2)} = \lim_{x \rightarrow 1} \frac{x+3-4}{(1-x)(\sqrt{x+3} + 2)} = \frac{\cancel{x-1} - 1}{(\cancel{1-x})(\sqrt{x+3} + 2)}$$

$$= \lim_{x \rightarrow 1} \frac{-1}{(\sqrt{x+3} + 2)} = \frac{-1}{4}$$

4. The point $(3, 5)$ is on the graph of $y = f(x)$. An equation of the line tangent to the graph of f at $(3, 5)$ is



- (a) $y = 2$
 (b) $y = 5$
 (c) $y - 5 = 2(x - 3)$
 (d) $y + 5 = 2(x - 3)$
 (e) $y + 5 = 2(x + 3)$

$y' \rightarrow m = 2$ or $f(3) = 5$ $f'(3) = 2$
 $y \rightarrow (3, 5)$
 $y - 5 = 2(x - 3)$

Free Response (10 pts. each)

1. Find the domain and extreme points of $y = x^3 - x^2 - x + 1$.

Domain:

Extreme Points:

2. Find the zeros, POE's, VA's and critical points of $y = \frac{9 - x^2}{x^2 - 7x + 10}$.

Zeros: $(-3, 0)$ $(3, 0)$

POE: none

VA: $x = 2, 5$

Critical Points: $f = 9 - x^2$
 $f' = -2x$

A.M.D.G.

3. Find the domain, zeros, and extreme points for $y = \frac{2x^3 + x^2 - 5x + 2}{2x^2 - 5x + 2}$.

~~Domain:~~

Zeros:

Extreme Points:

Directions: Complete each of the following NEATLY IN PENCIL in the space provided. Show all work; round at THREE decimal places. Good Luck.

Multiple Choice (3 pts. each)

5. Let f be a function defined for all real numbers x . If $f'(x) = \frac{4-x^2}{x-2}$, then f is increasing on the interval

(a) $(-\infty, -2)$

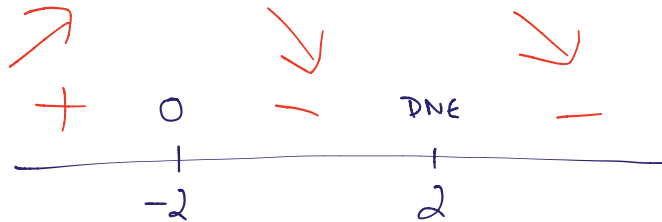
(b) $(-\infty, \infty)$

(c) $(-2, 2)$

(d) $(-2, \infty)$

(e) $(-2, 2) \cup (2, \infty)$

$$-1 \frac{(2-x)(2+x)}{(x-2)}$$



6. What is $\lim_{h \rightarrow 0} \frac{8(x+h)^8 - 8x^8}{h}$?

(a) 0

(b) $8x^7$

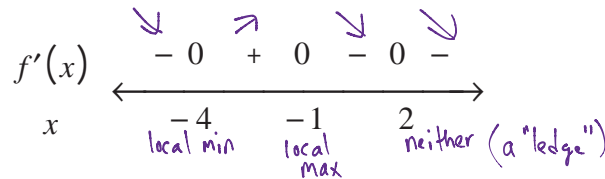
(c) $64x^7$

(d) $64x^8$

(e) It cannot be determined from the given information

Derivative Definition ($f'(x)$)
 with $f(x) = 8x^8 \Rightarrow$ just use the Power Rule to find $f'(x)$

9. Given the sign pattern below, at what value of x does f have a local minimum?



(a) -4

(b) -1

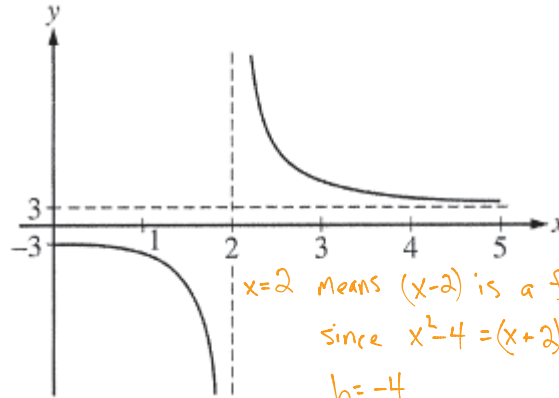
(c) 2

(d) 1

(e) no value

10. The function f is given by $f(x) = \frac{ax^2 + 12}{x^2 + b}$. The figure below shows a portion of the graph of f . Which of the following could be the values of the constants a and b ?

- (a) $a = -3; b = 2$
- (b) $a = 2; b = -3$
- (c) $a = 2; b = -2$
- (d) $a = 3; b = -4$
- (e) $a = 3; b = 4$



$x=2$ means $(x-2)$ is a factor of x^2+b
 since $x^2-4 = (x+2)(x-2)$
 $b = -4$

Free Response (10 pts. each)

4. Find all traits and sketch $y = x^3 - x^2 - x + 1$.

Domain: All reals

Zeros: $\left. \begin{array}{c} \begin{array}{cccc} 1 & -1 & -1 & 1 \\ 1 & 0 & -1 & 0 \end{array} \\ \hline \end{array} \right\} (x-1)(x^2-1) = (x+1)(x-1)^2$

y-int: $(0, 1)$

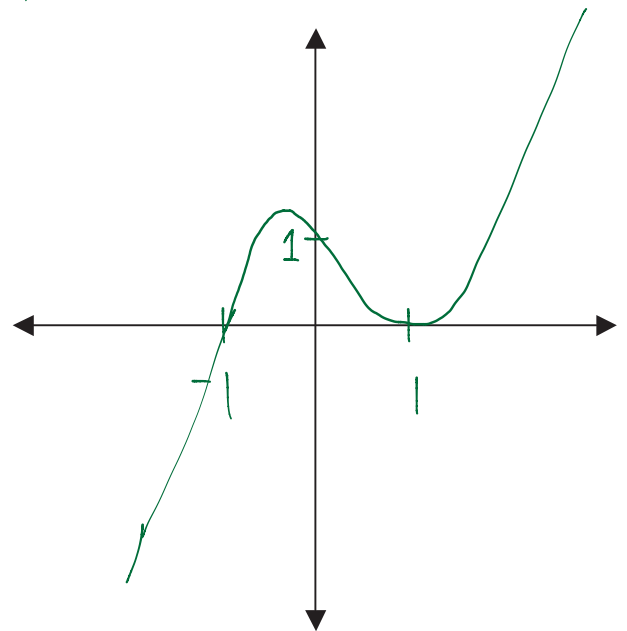
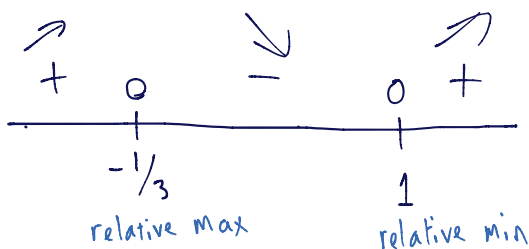
~~VAs:~~

~~EB:~~

~~POEs:~~ Find critical values

Extreme Points: $y' = 3x^2 - 2x - 1 = 0$

Range: $(3x+1)(x-1) = 0$
 $x = -\frac{1}{3}, 1$



$$f\left(-\frac{1}{3}\right) = \frac{32}{27} \approx 1.185$$

$$f(1) = 0$$

A.M.D.G.

5. Find all traits listed below of $y = \frac{9-x^2}{x^2-7x+10} = \frac{(3-x)(3+x)}{(x-5)(x-2)}$

Zeros:

$$y' = \frac{(-2x)(x^2-7x+10) - (2x-7)(9-x^2)}{(x^2-7x+10)^2}$$

y-int:

$$= \frac{-2x^3 + 14x^2 - 20x - (18x - 2x^3 - 16 + 7x^2)}{(x^2-7x+10)^2}$$

VAs:

$$(x^2-7x+10)^2$$

POEs:

$$= \frac{-2x^3 + 14x^2 - 20x - 18x + 2x^3 + 16 - 7x^2}{(x^2-7x+10)^2}$$

~~Critical Values:~~

Just find y'

E.B. Horizontal Asymptote $y = \frac{-x^2}{x^2} = -1 = \frac{7x^2 - 38x + 63}{(x^2-7x+10)^2}$

6. Find all traits listed below of $y = \frac{2x^3 + x^2 - 5x + 2}{2x^2 - 5x + 2}$

$$= \frac{(x+2)(2x-1)(x-1)}{(2x-1)(x-2)}$$

Domain: $x \in (-\infty, \frac{1}{2}) \cup (\frac{1}{2}, 2) \cup (2, \infty)$

Zeros: $(-2, 0)(1, 0)$

y-int: $(0, 1)$

VAs: VA: $x=2$

POEs: $(\frac{1}{2}, -\frac{5}{2}) \leftarrow \frac{(x+2)(2x-1)(x-1)}{(2x-1)(x-2)}$ plug in $\frac{1}{2}$ after cancelling to get $-\frac{5}{2}$

~~Critical values~~ y'

$$\frac{x^2 + x - 2}{x-2}$$

$$\Rightarrow \begin{aligned} f &= x^2 + x - 2 \\ f' &= 2x + 1 \end{aligned}$$

$$\begin{aligned} g &= x - 2 \\ g' &= 1 \end{aligned}$$

$$y' = \frac{(2x+1)(x-2) - (x^2+x-2)}{(x-2)^2} = \frac{2x^2 - 3x - 2 - x^2 - x + 2}{(x-2)^2}$$

E.B.: Slant Asymptote

$$= \frac{x^2 - 4x}{(x-2)^2} = \frac{x(x-4)}{(x-2)^2}$$

$$\begin{array}{r} x+3 \\ x-2 \overline{) x^2+x-2} \\ \underline{-(x^2-2x)} \\ +3x-2 \\ \underline{-(3x-6)} \\ 4 \end{array} \quad y = x+3$$