

Honors PreCalculus
 Rational Functions Test
 CALCULATOR ALLOWED

Name: Soluna Key
 Score 32/32

Round to 3 decimal places.
 Multiple Choice (3 pts.)

1. $\lim_{h \rightarrow 0} \frac{3\left(\frac{1}{2}+h\right)^5 - 3\left(\frac{1}{2}\right)^5}{h} = \frac{d}{dx} \Big|_{x=\frac{1}{2}} \left(3x^5 - 23x \right) = 15x^4 = \frac{15}{16}$

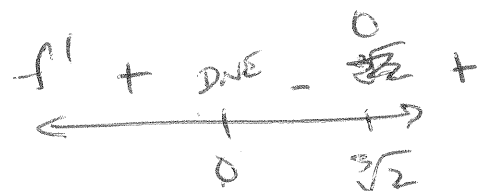
a) 0 b) 1 **c) $\frac{15}{16}$** d) the limit does not exist

e) the limit cannot be determined

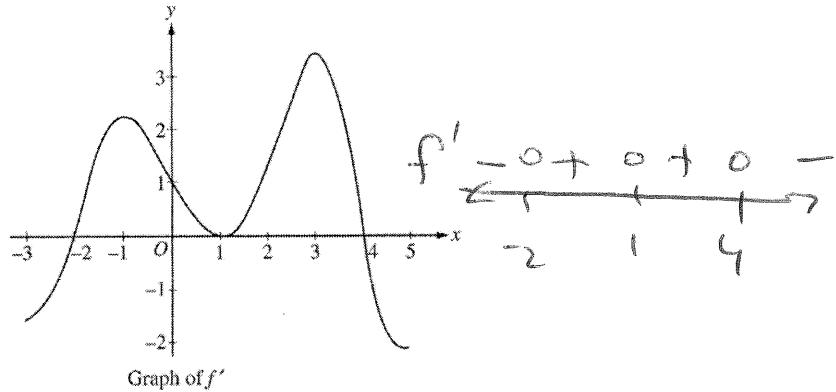
2. Let f be the function with derivative given by $f'(x) = x^2 - \frac{2}{x}$. On which of the following interval is f decreasing

a) $(-\infty, -1)$ b) $(-\infty, 0)$ c) $(-1, 0)$

d) $(0, \sqrt[3]{2})$ e) $(\sqrt[3]{2}, \infty)$



3. The graph of the derivative of a function f is shown in the figure below. The graph has horizontal tangent lines at $x = -1$, $x = 1$, and $x = 3$. At which of the following values of x does f have a relative maximum?



- a) -2
 b) 1
 c) 4
 d) -1 and 3
 e) -2, 1, and 4

4. An equation of the line tangent to the graph of $y = \frac{2x+3}{3x-2}$ at $(1, 5)$ is

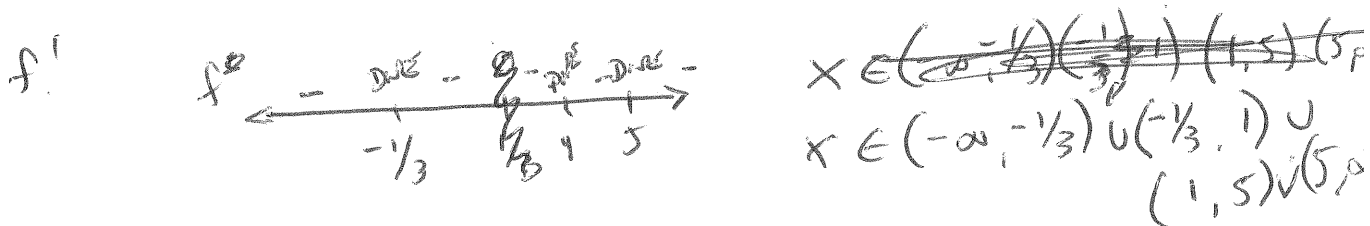
- a) $13x - y = 8$
 b) $13x + y = 18$
 c) $x - 13y = 64$
 d) $x + 13y = 66$
 e) $-2x + 3y = 13$
- $$\frac{dy}{dx} = \frac{(3x^2 - 2)(2) - (2x + 3)(3)}{(3x^2 - 2)^2}$$

$$M = \left. \frac{dy}{dx} \right|_{x=1} = -13$$

Free Response (10 pts. each)

5. Make a sign pattern and use it to find the intervals of decreasing of

$$y = \frac{3x^2 - 16x + 5}{3x^3 - 17x^2 + 9x + 5} = \frac{(3x - 4)(x - 5)}{(3x + 1)(x - 1)(x - 5)}$$



6. Find the traits and **sketch** $y = \frac{3x^2 - 16x + 5}{3x^3 - 17x^2 + 9x + 5}$.

Domain: $x \neq \frac{1}{3}, 1, 5$

Y-Int: $(0, 1)$

Zeros: $(\frac{1}{3}, 0)$

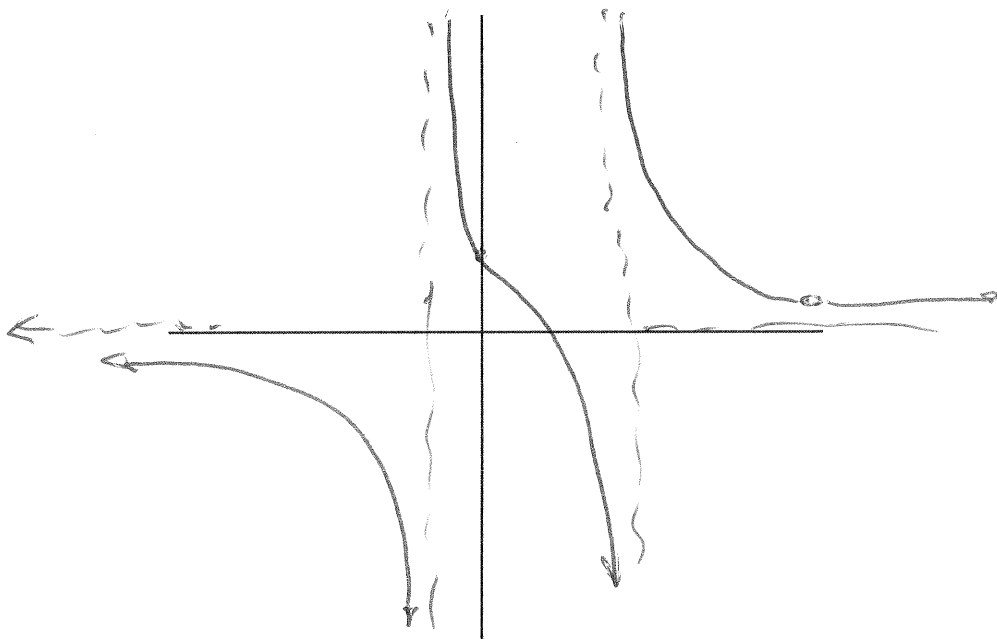
VAs: ~~$x = \frac{1}{3}$~~ $x = -\frac{1}{3}$ $x = 1$

POEs: $(5, \frac{7}{32})$

Extreme Values: NONE

End Behavior: $y = 0$

Range: ALL REALS



Honors PreCalculus
 Polynomials Test
 NO CALCULATOR ALLOWED

Name: _____

Score _____

Round to 3 decimal places.
 Show all work.
 Multiple Choice (3 pts.)

7. Consider the function $f(x) = \frac{6x}{a+x^3}$, for which $f'(0) = 3$. The value of a is

- a) 5 b) 4 c) 3 **d) 2** e) 1

$$f' = \frac{(a+x^3)(6) - 6x(3x^2)}{(a+x^3)^2}$$

$$\text{If } y = \frac{2x+3}{3x+2}, \text{ then } \frac{dy}{dx} = \frac{(2x+3)(3) - (3x+2)(2)}{(3x+2)^2}$$

$$\frac{6}{a} = 3$$

$$a = 2$$

- a) $\frac{12x+13}{(3x+2)^2}$ b) $\frac{12x-13}{(3x+2)^2}$ ~~c) $\frac{5}{(3x+2)^2}$~~

- d) $\frac{-5}{(3x+2)^2}$** e) $\frac{2}{3}$

$$= \frac{6x^4 - 9}{3x^2}$$

9. $\lim_{x \rightarrow \infty} \frac{(2x-1)(3-x)}{(x-1)(x+3)} =$

- a) 3 b) 2 **c) -2** d) -3 e) dne

12. Find the traits and **sketch** $x^2y + x^2 + 4y - 4 = 0$.

Domain: ALL REALS

Y-Int: $(0, \Phi)$

Zeros: $(\pm 2, 0)$

VAs: NONE

POEs: ~~NONE~~ NONE

Extreme Values: ~~0~~ $(0, 1)$

End Behavior: $y = -1$

Range: $y \in (-1, \square]$

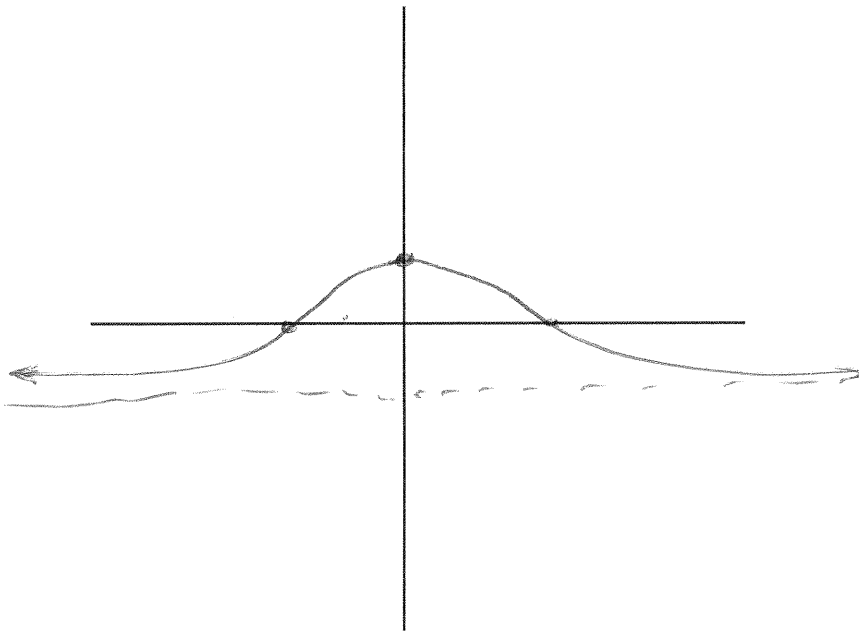
$$2x(x^2+4)y = 4-x^2$$

$$y = \frac{4-x^2}{x^2+4}$$

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

$$= \frac{-16x^2}{(x^2+4)^2} = 0$$

$$x=0$$



10. For $x > 0$, the horizontal line $y = 2$ is an asymptote for the graph of the function f . Which of the following statements must be true?

a) $f(0) = 2$

b) $f(0) \neq 2$ for all $x \geq 0$

c) $f(2)$ is undefined

d) $\lim_{x \rightarrow 2} f(x) = \infty$

e) $\lim_{x \rightarrow \infty} f(x) = 2$

Free Response (10 pts. each)

11. Create an **equation** of a rational function that has an x -intercept at $(-2, 0)$, a VA at $x = 6$, POE at $x = -3$, and a HA at $y = 3/5$.

$$y = \frac{3(x+2)(x+3)}{5(x-6)(x+3)}$$