

Exam 3 old ones (2PM)

1. a) 1 e) -1
 b) 1 f) -1
 c) 1 g) 1
 d) 0 h) DNE

$$2. \lim_{x \rightarrow 5} \frac{x^2 - 3x - 10}{3x - 15} \rightarrow \frac{25 - 15 - 10}{15 - 15} = \frac{0}{0}$$

$$\lim_{x \rightarrow 5} \frac{(x-5)(x+2)}{3(x-5)} = \lim_{x \rightarrow 5} \frac{x+2}{3} = \boxed{\frac{7}{3}}$$

3. a) DNE c) 2/7
 b) 0 d) 0

$$4. f(x) = \frac{5x^2 - 10x}{x^2 + 3x - 10} = \frac{5x(x-2)}{(x+5)(x-2)}$$

a) discont. at $x=2$ & $x=-5$

$$b) \lim_{x \rightarrow 2} \frac{5x(x-2)}{(x+5)(x-2)} = \boxed{\frac{10}{7}}$$

$$\lim_{x \rightarrow -5} \frac{5x(x-2)}{(x+5)(x-2)} = \frac{-25}{0} \boxed{\text{DNE}}$$

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$$f(x) = \begin{cases} 40x & \text{if } x \leq 50 \\ 2000 + 35(x-50) & \text{if } x > 50 \end{cases}$$

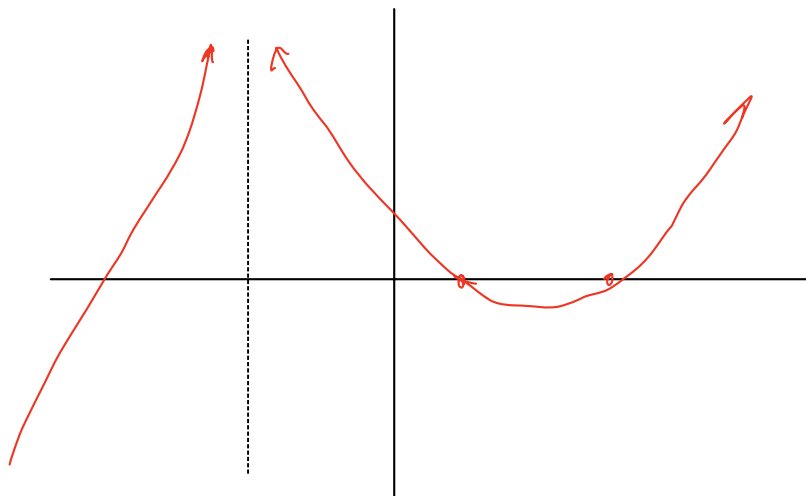
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$$\begin{aligned} \frac{f(2) - f(-1)}{2 - (-1)} &= \frac{4 \cdot 2^2 + 3 \cdot 2 - (4 \cdot (-1)^2 + 3 \cdot (-1))}{3} \\ &= \frac{16 + 6 - (4 - 3)}{3} = \boxed{\frac{21}{3}} \end{aligned}$$

7.

$$f(x) = 3x^2 - 5x$$

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 5(x+h) - (3x^2 - 5x)}{h} \\ &= \lim_{h \rightarrow 0} \frac{3(x^2 + 2xh + h^2) - 5x - 5h - 3x^2 + 5x}{h} \\ &= \lim_{h \rightarrow 0} \frac{\cancel{3x^2} + 6xh + 3h^2 - \cancel{5x} - 5h - \cancel{3x^2} + \cancel{5x}}{h} \\ &= \lim_{h \rightarrow 0} \frac{6xh + 3h^2 - 5h}{h} = \lim_{h \rightarrow 0} \frac{\cancel{h}(6x + 3h - 5)}{\cancel{h}} \\ &= \lim_{h \rightarrow 0} 6x + 3h - 5 = 6x + 3 \cdot 0 - 5 = \boxed{6x - 5} \end{aligned}$$

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$$l(t) = 10 + 2t + t^{-1}$$

a) $l(4) = 10 + 2 \cdot 4 + \frac{1}{4} = 18.25$

On day 4, the plant is 18.25 in. long.

b) $l'(t) = 2 - t^{-2}$

$$l'(4) = 2 - \frac{1}{4^2} = \underline{2 - 1/16}$$

On day 4, the plant is growing at a rate of $\boxed{2 - 1/16}$ inches/day.

10 a) $12x^3 + 8$

b) $18x^2 + 4x^{-5} + 7$

c) $3 \cdot \frac{1}{2} x^{-1/2} - 5$

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$$(4x^3 - 2x^2)(6x - 7) + (1 + 3x^2 - 7)(12x^2 - 4x)$$

$$(7x^3 - 2x)(10x + 12x^3) - (5x^2 + 3x^4)(21x^2 - 2)$$

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$$(7x^3 - 2x)^2$$

$$\underline{13} \quad 5(15x^2 + 7x)^4 \cdot (30x + 7)$$

$$\underline{14} \quad \frac{(3x - 7x^3) \cdot \frac{1}{2}(4x^2 + 3x)^{-1/2} \cdot (8x + 3) - \sqrt{4x^2 + 3x} \cdot (3 - 21x^2)}{(3x - 7x^3)^2}$$

$$\underline{15} \quad \underline{a} \quad 6^x \ln 6$$

$$\underline{b} \quad e^{x^2+4x} (2x+4)$$

$$\underline{c} \quad 3 \cdot 5^{2x} \ln 5 \cdot 2$$

$$\underline{16} \quad \begin{array}{ll} a) 2 & c) -3 \\ b) \text{impossible} & d) 1/2 \end{array}$$

$$\underline{17} \quad a) \frac{1}{x \ln 8}$$

$$b) \frac{1}{x^3 + 2x + 1} \cdot (3x^2 + 2)$$

$$c) \frac{1}{5x \ln 2} \cdot 5$$

$$\underline{18} \quad \frac{(1 + e^{5x^2-3x})(12x^2 + 4^x \ln 4) - (4x^3 + 4^x) \cdot e^{5x^2-3x} (10x - 3)}{(1 + e^{5x^2-3x})^2}$$

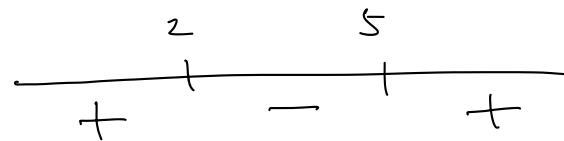
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$$f(x) = 6x^2 - 42x + 60$$

$$= 6(x^2 - 7x + 10)$$

$$= 6(x-5)(x-2)$$

$$x = 2 \text{ \& } 5$$



$$f'(0) = 6(0-5)(0-2)$$

+ - -

$$f'(3) = 6(3-5)(3-2)$$

+ - +

$$f'(6) = 6(6-5)(6-2)$$

+ + +

increasing: $(-\infty, 2)$ & $(5, \infty)$

decreasing: $(2, 5)$

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$$f(x) = x^2 e^{2x}$$

$$f'(x) = x^2 \cdot e^{2x} \cdot 2 + e^{2x} \cdot 2x$$

$$= 2x e^{2x} (x+1)$$

$f' = 0$:

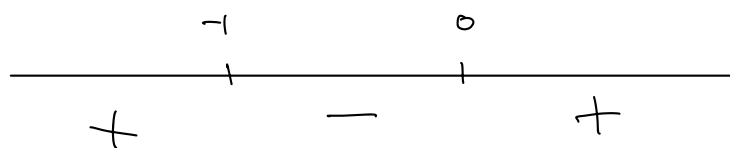
$$2x = 0$$

~~$$e^{2x} = 0$$~~

$$x+1 = 0$$

$$x = 0$$

$$x = -1$$



$$f'(-2) = 2(-2) e^{2 \cdot -2} (-2+1)$$

+ - + -

$$f'(-.5) = 2(-.5) e^{2 \cdot -.5} (-.5+1)$$

+ - + +

$$f'(1) = 2 \cdot 1 \cdot e^{2 \cdot 1} \cdot (1+1)$$

+ + + +

inc on $(-\infty, -1)$
& $(0, \infty)$

dec on $(-1, 0)$