

Practice Midterm 2

$$1) a) \quad f'(x) = \frac{1}{2}x^{-\frac{1}{2}}(5x^2 - \sqrt{x}) + \sqrt{x} \cdot (10x - \frac{1}{2}x^{-\frac{1}{2}})$$

$$= \frac{5}{2}x^{\frac{3}{2}} - \frac{1}{2} + 10x^{\frac{3}{2}} - \frac{1}{2}$$

$$= \frac{25}{2}x^{\frac{3}{2}} - 1$$

$$b) \quad g'(x) = \frac{3x^2(2+e^x) + e^x \cdot x^3}{(2+e^x)^2}$$

$$c) \quad h'(x) = (\sec^2(x^5+5)) \cdot (5x^4)$$

$$2) \quad y = x^4 - 6x^2$$

$$a) \quad y' = 4x^3 - 12x > 0$$

$$4x(x^2-3) > 0$$

$$(x > 0 \ \& \ x^2-3 > 0) \text{ or } (x < 0 \ \& \ x^2-3 < 0)$$

$\therefore$ When $x > \sqrt{3}$ or $-\sqrt{3} < x < 0$, y is increasing

$$b) \quad y'' = 12x^2 - 12 < 0$$

$$x^2 - 1 < 0$$

$$(x+1)(x-1) < 0$$

$\therefore$ When $-1 < x < 1$, y is concave down

$$3) a) \quad h'(x) = f'(g(x)) \cdot g'(x)$$

$$\begin{aligned} h'(3) &= f'(g(3)) \cdot g'(3) \\ &= f'(0) \cdot g'(3) \end{aligned}$$

Since we don't know $f'(0)$, so cannot compute $h'(3)$

$$b) \quad k'(x) = g'(f(x)) \cdot f'(x)$$

$$\begin{aligned} k'(2) &= g'(f(2)) \cdot f'(2) \\ &= g'(3) \cdot f'(2) \\ &= 4 \cdot 1 = 4 \end{aligned}$$

$$4) a) \quad D'(25) = 0.02$$

At 25th day, the length of daylight is increasing at a rate of 0.22 hours/day

b) At 45th day of the year, length of daylight is 11 hours in San Diego

c) $\frac{\text{day}}{\text{hours}}$