1. Suppose you are given $f(x) = \frac{2}{3}x^3 - 8x$, so that $f'(x) = 2x^2 - 8$. Using a **sign chart,** determine where the function is increasing and decreasing. Write your answer in **interval notation.**

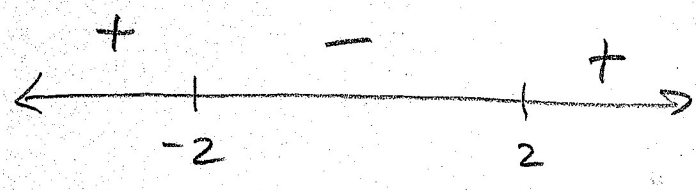
+8

$2x^2 - 8 = 0$

$2x^2 = 8$

$x^2 = 4$

$x = -2, +2$



Increasing: $(-\infty, -2), (2, \infty)$

Decreasing: $(-2, 2)$

Test points: -3 $\quad 0$ $\quad 3$

2. Evaluate the following limits, using L'Hôpital's Rule when appropriate.

+2 (a) $\lim_{x\to\infty} x^2e^x$

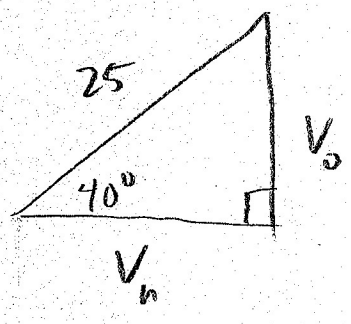
+8 (b) $\lim_{x\to-\infty} x^2e^x$

(a) $\infty \cdot \infty$ DNE $(+\infty)$

(b) $\lim_{x\to-\infty} \frac{x^2}{e^{-x}} \overset{LR}{=} \lim_{x\to-\infty} \frac{2x}{-e^{-x}} \overset{LR}{=} \lim_{x\to-\infty} \frac{2}{e^{-x}}$

$= \lim_{x\to-\infty} 2e^x = 0$

3. Suppose you throw a baseball at an angle of 40° at 25 m/s. Write the displacement equations for this scenario. No need to solve.



$y(t) = -4.9t^2 + 16.1t + 2$

$x(t) = 19.2t$

$V_h = 25 \cos 40° \approx 19.2$

$V_0 = 25 \sin 40° \approx 16.1$

4. You are standing on the roof of a building which is 40 m tall. You drop a marble down from the roof at 15 m/s. How long will it take to hit the ground?

$$s(t) = -4.9t^2 - 15t + 40 = 0$$

$$t = \frac{15 \pm \sqrt{(-15)^2 - 4(-4.9)(40)}}{2(-4.9)}$$

$$= \frac{15 \pm 31.76}{-9.8}$$

Choose the positive root: $t = \frac{15 - 31.76}{-9.8} \approx 1.71s$