NAME: Solution

MAC 2311 Section 3071
Quiz Seven

Please show all of your work in a NEAT and ORGANIZED fashion.

1. Let $f(x) = x^3 - \frac{3}{2}x^2 - 36x + 2$.

(a) (1 point) Find the intervals on which f is increasing or decreasing.

$$f'(x) = 3x^2 - 3x - 36 = 0$$
$$x^2 - x - 12 = 0$$
$$(x-4)(x+3) = 0$$

$+ \quad - \quad +$

$-3 \quad 4$

inc: $(-\infty, -3) \cup (4, \infty)$
dec: $(-3, 4)$

(b) (1 point) At what values of x does f have a local maximum or local minimum? **Explain.**

f has a local maximum at $x = -3$ because f' changes from positive to negative; f has a local minimum at $x = 4$ because f' changes from negative to positive.

(c) (1 point) Find the intervals of concavity ~~and any inflection points.~~

$$f''(x) = 6x - 3 = 0$$
$$2x - 1 = 0$$

$- \quad +$

$1/2$

concave up: $(\frac{1}{2}, \infty)$
concave down: $(-\infty, \frac{1}{2})$

2. (3 points) Find the limit.

$$\lim_{x \to \infty} x^{e^{-x}}$$

$$y = x^{e^{-x}} \longrightarrow \ln y = e^{-x} \ln x = \frac{\ln x}{e^x}$$

$$\lim_{x \to \infty} \ln y = \lim_{x \to \infty} \frac{\ln x}{e^x}$$
$$= \lim_{x \to \infty} \frac{1/x}{e^x}$$
$$= \lim_{x \to \infty} \frac{1}{xe^x} = 0.$$

So $\lim_{x \to \infty} x^{e^{-x}} = \lim_{x \to \infty} y = \lim_{x \to \infty} e^{\ln y} = e^0 = 1.$