

Math 131 - Study Session Problems

1 Optimization

1. For each function $f(x)$, find the global extrema on the given interval.

(a) $f(x) = 3x^4 + 4x^3 - 12x^2$

i. $[-1, 1]$

ii. $[-3, 3]$

iii. $(-2, 1)$

(b) $f(x) = e^x(x^2 - 3)$

i. $[0, 1]$

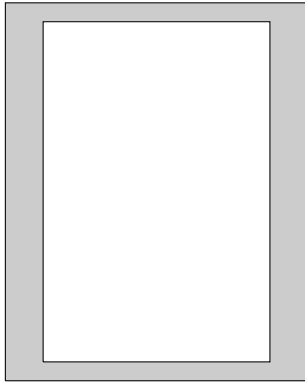
ii. $(-\infty, \infty)$

2. Find numbers a and b that sum to 50 and whose product is as large as possible.

3. Find positive numbers a and b that multiply to 10 and whose sum is as small as possible.

4. Find the point on the line $y = 3x + 3$ that is closest to the origin.

5. Emmy needs to make flyers for an upcoming tag sale. Each flyer must contain 20 square inches of printed material and Emmy would like to have margins of 2 inches on the sides and margins of 1 inch on the top and bottom. (The margins are shaded in the image below.) What size paper should Emmy use to minimize the total area of each flyer?



2 L'Hopital's Rule

6. Calculate the following limits using L'Hopital's Rule.

(a) $\lim_{x \rightarrow 9} \frac{\sqrt{x} - 3}{9 - x}$

(b) $\lim_{x \rightarrow \infty} \frac{x^2 - 5x}{5x^2 - x - 1}$

(c) $\lim_{x \rightarrow 0} \frac{\sin(2x)}{5x}$

(d) $\lim_{x \rightarrow 0} \frac{2 - 2\cos(3x)}{3x^2}$

(e) $\lim_{x \rightarrow \infty} 2xe^{-2x}$