# EXAM 1 - MATH 112                    Thursday, February 8
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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1.  (a) A line $\ell$ passes through the points $(-5, 0)$ and $(5, 20)$. Find an equation for the line $\ell'$ that is perpendicular to the line $\ell$ and passes through $(4, 12)$.

    (b) Find the domain of the function $f(x) = \dfrac{x^2 + 6x + 5}{x^2 - 5x - 50}$.

2. A certain manufacturer has fixed costs \$500 and variable costs \$10 per each item produced. Suppose its revenue function is $R(x) = -x^2 + 70x$, where $x$ is the number of items produced and sold.

(a) Find the cost function $C(x)$.

(b) Find the break-even point(s).

(c) Find an equation for the profit function $P(x)$.

(d) Find the number of items that need to be produced to maximize the profit. Explain your work.

3. Compute the difference quotient of $f(x) = \frac{1}{x+7}$ at $x = -2$ and simplify.

4. The depth of water in a local lake was measured to be $f(t) = \sqrt{5t+1}$ feet at time $t$ in months. Find the instantaneous rate of change of the depth at time $t = 3$.

5. Consider the piece-wise defined function

$$f(x) = \begin{cases} \dfrac{3-x}{x^2-x-6}, & \text{if } x < 3 \\ -\dfrac{1}{2}, & \text{if } x = 3 \\ \dfrac{\sqrt{x-2}-1}{3-x}, & \text{if } x > 3 \end{cases} \quad .$$

Calculate the following:

$f(3) =$

$\displaystyle\lim_{x\to 3^-} f(x) =$

$\displaystyle\lim_{x\to 3^+} f(x) =$

$\displaystyle\lim_{x\to 3} f(x) =$

State the type of continuity of $f$ at $x = 3$, if any.