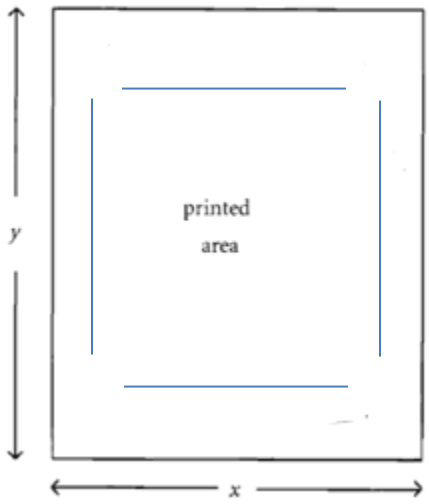
Math 454 Practice Problems Name: _____

**Curve Sketching , Optimization & Linear Approx** Date: _____

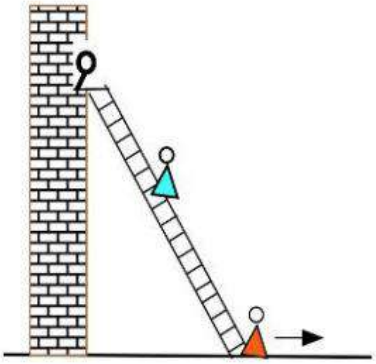
Scientific Calculator ONLY.

**Answer each question. Show all work. Round answers to three decimal places.**

1) You are designing a rectangular poster to contain $50\,in^2$ of printing with a 4-inch margin at the top and bottom and a 2-inch margin at each side. What overall dimensions will minimize the amount of paper used? [Please conclude with a sentence.]



2) **Related Rates.** A young woman and her boyfriend plan to elope, but she must rescue him from his mother who has locked him in his room. The young woman has placed a 20 foot long ladder against his house and is knocking on his window when his mother begins pulling the bottom of the ladder away from the house at a rate of 3 feet per second. **How fast is the top of the ladder (and the young couple) falling when the bottom of the ladder is 12 feet from the bottom of the wall?** *[ include units]* Is the ladder falling at a constant rate? _____



3) a) Use linear approximation to approximate the quantity $(1.98)^3$ using $f(x)=x^3$ and $a=2$ .

b) Find the actual value to 3 decimal places.

_____

4) **True/False.**

_____a) If $f$ is a differentiable function and $f(2)=6$ and $f'(2)=-\frac{1}{2}$ , then the approximate value of $f(2.1)$ is 5.95.

_____b) Given that a function $f$ is twice differentiable and concave down at $a=5$. Using linear approximation to find $f(5.1)$ our estimate will be an overestimate.

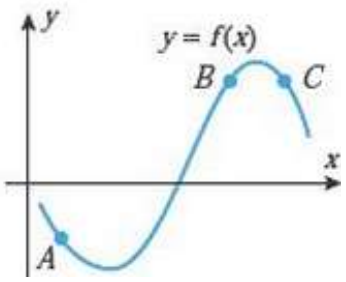
_____c) Relative extrema can only occur where the first derivative is zero.

_____d) If $f''(x)>0$ , then $f$ has a relative minimum at $x=1$ .

5) Solve for $a$ and $b$ given that the given function is continuous and differentiable:

$$f(x)=\begin{cases} ax+b, & x>-1 \\ bx^2-3, & x\le -1 \end{cases}$$

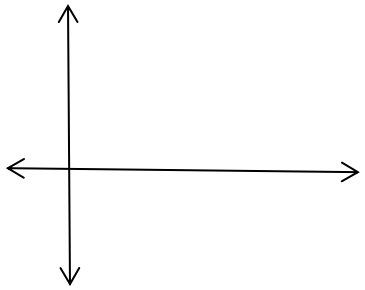
6) Use the graph of the equation $y=f(x)$ in the accompanying figure to find the signs of $dy/dx$ and $d^2y/dx^2$ at the points A, B, and C.




A: $dy/dx$ ____
$d^2y/dx^2$ ____
B: $dy/dx$ ____
$d^2y/dx^2$ ____
C: $dy/dx$ ____
$d^2y/dx^2$ ____

7) Find the shortest distance from the curve $y=\sqrt{x}$ to the point (4, 0) .

*include a sketch



Multiple Choice. Select the best answer.

_____8) Given function $f$ defined by $f(x)=(1-x)^3$ . What are all value(s) of $c$ , in the closed interval [0,3], that satisfy the conditions of the ***Mean Value Theorem***?

a) $c=1, only$ b) $c=2, only$

c) $c=0, only$ d) $c=0$ *and* $c=2$

e) $c=1$ *and* $c=2$

_____9) On what interval is $f(x)=\dfrac{2x-3}{x^2}$ increasing?

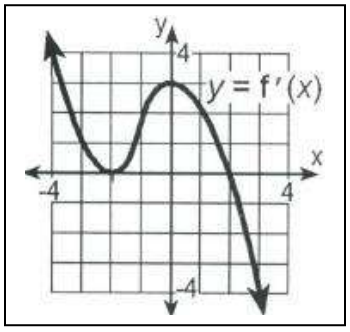
a) $(-\infty, 3]$

b) $(0, \infty)$

c) $[3, \infty)$

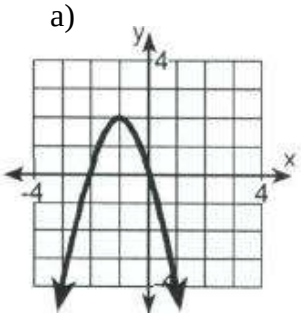
d) $(0, 3]$

e) $(-\infty, -3]$

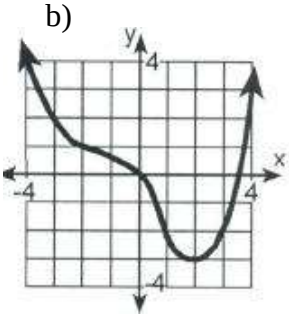



_____10) The graph of the ***derivative on function*** $f$ is shown.
Which of the following could be a graph of function $f$ .

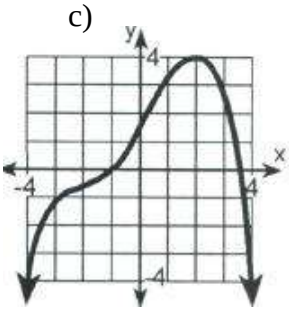
a)




b)




c)




d)