

TO RECEIVE FULL CREDIT ON PROBLEMS YOU MUST SHOW YOUR WORK!!!
(If you are using a graphing calculator you must show even more work!)

1. (10) **Find an equation** of the line passing through the points (2, -1) and (0,1).

2. (5) **Find the limit** or state that it does not exist:

$$\lim_{x \rightarrow 3} \frac{x^2 - x - 6}{x - 3} =$$

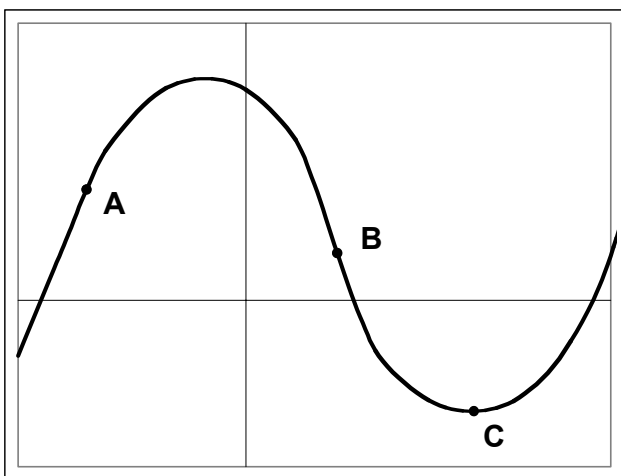
3. (10) **Find the derivative** of each of the following:

a) $y = x^5 + \frac{4}{x} + 7$

b) $y = \frac{1}{2}(5x + 2)^{10}$

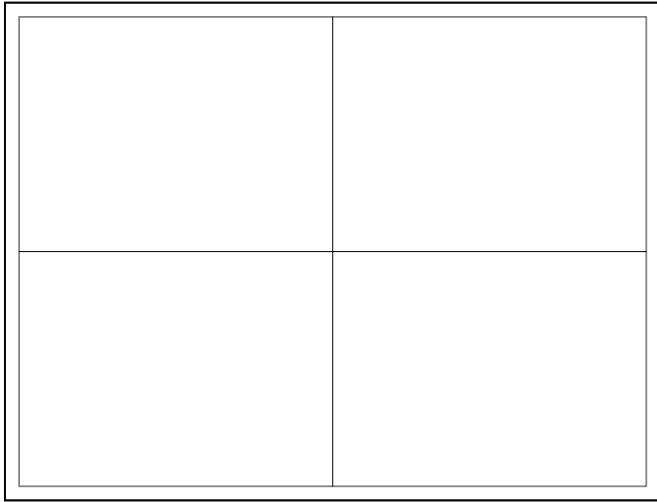
4. (10) Let $f(x) = x^2 - 6x + 4$. Show that $f'(x) = 2x - 6$ **using** $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$

5. (10) **Fill in** each entry of the table with "+", "-", or "0" if $f(x)$, $f'(x)$, or $f''(x)$ is positive, negative, or zero at points A, B, and C respectively.



	A	B	C
$f(x)$			
$f'(x)$			
$f''(x)$			

6. (15) Using calculus (not a graphing calculator) **find** all the relative extreme points, **determine** what kind of extrema they are, and **find** all inflection points of $f(x) = -\frac{1}{9}x^3 + x^2 + 9x$. Using this information **graph** the function. (A correct graph without supporting work will receive no credit!)

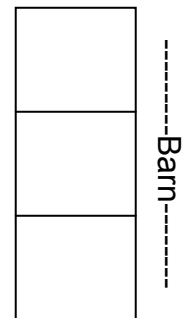


List any relative maxima: _____

List any relative minima: _____

List any inflection points: _____

7. (15) Three pens are to be constructed along the side of a barn as illustrated. There is 160 feet of fencing available. No fencing will be needed along the side of the barn. **Find the dimensions** that will maximize the total enclosed area.



8. (20) **Find the derivative** of each of the following:

a) $f(x) = x^5(x^3 + 4x - 2)$

b) $f(x) = \frac{6x + 4}{2x - 3}$

c) $f(x) = e^{x^3 - 2x + 1}$

d) $f(x) = \ln(4x + 1)$

9. (10) **Solve** each of the following for x:

a) $2e^{3x} = 8$

b) $\ln(x - 3) - 7 = 0$

10. (10) **Find the coordinates** of each relative extreme point for $f(x) = \frac{1}{2}e^{-2x} + 24x$. **Determine** if each is a relative maximum or minimum.

11. (10) In the beginning there are 1000 cells in a bacteria culture. Let $P(t)$ be the number of cells present in the culture after t hours. Suppose that $P(t)$ satisfies the differential equation $P'(t) = 0.45P(t)$.

a) **Find the formula** for $P(t)$.

b) **How many** bacteria will be present after 3 hours?

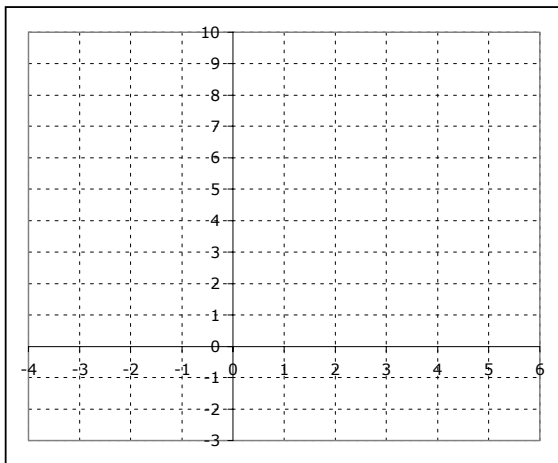
12. (10) A small tie shop finds that at a sales level of x ties per day its marginal profit is $MP(x) = 1.3 + 0.06x - 0.0018x^2$ dollars per tie. Also, the shop will lose \$95 per day at a sales level of $x = 0$. **Find the profit equation** for operating the shop at a sales level of x ties per day.

13. (10) **Evaluate** each of the following:

a) $\int_1^2 (3x^2 + 2x) dx$

b) $\int_1^4 (3 + \sqrt{x}) dx$

14. (15) **Set up** the integral necessary to find the area of the region bounded by the curves $y = -x^2 + 6x$ and $y = 2x$. Also **sketch** the region. You do **not** need to evaluate the integral.



15. (10) **Set up** the integral necessary to find the volume of the solid formed by rotating the function $f(x) = \sqrt{x}$ around the x axis from $x = 1$ to $x = 4$. You do **not** need to evaluate the integral.

16. (10) **Evaluate** each of the following:

a) $\int \frac{24x+1}{12x^2+x-3} dx$

b) $\int xe^{3x^2} dx$

17. (10) **Find all point(s)** (x,y) where $f(x,y) = -x^2 + 2y^2 + 6y - 8x + 5$ has a possible relative maximum or minimum. You do **not** need to determine whether the point(s) are maxima or minima.

18. (10) Using the method of Lagrange multipliers, **maximize** the function $f(x,y) = 3x^2 + 2xy - y^2$, subject to the constraint $5 - 2x - y = 0$.