Mathematics 122 Test #3 Name: ____________________

You are to use your own calculator, no sharing.
Show your work to get credit.

(1) (10 points) Find the following derivatives where a, b, c are constants.

(a) $y = ae^{2x} + 4b^c$ $y' =$ ____________________

(b) $A = \dfrac{b+r}{c+r}$ $\dfrac{dA}{dr} =$ ____________________

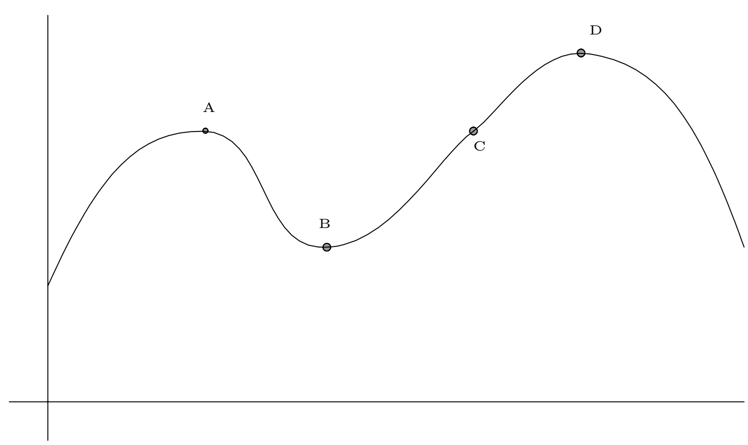
(2) (15 points) Compute the following definite integrals.

(a) $\displaystyle\int_0^2 \frac{1}{\sqrt{1+x^3}}\, dx =$

(b) $\displaystyle\int_{-1}^2 \frac{t^2}{4+t^4}\, dt =$

(c) $\displaystyle\int_2^4 2^u \ln(u)\, du =$

(3) (10 points) For the points labeled in the figure answer the following.



(a) Which of the points are local maximums? ____________________

(b) Which of the points are local minimums? ____________________

(c) At which of the points is the derivative positive? ____________________

(4) (10 points) Use your calculator to sketch a graph of $y = e^x - 2x$ and to find all the local maximizers and local minimizers of the function.

Local maximizers ______________________

Local minimizers ______________________

(5) (10 points) Find the global maximum of $A(r) = 4r - r^3$ on the interval $0 \leq r \leq 5$.

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(6) (10 points)

(a) Draw a graph of a function $y = f(x)$ with $f'(2) = 0$ and $f''(x) > 0$.

(b) Is $x = 2$ a maximizer or minimizer of $f(x)$. ______________________

(7) (10 points) When you sneeze, your windpipe contracts, The speed, v, with which air comes out depends on the radius, r, of your windpipe. If R is the normal (rest) radius of your windpipe, then for $0 \leq r \leq R$ the speed is given by

$$v = a(R - r)r^3, \qquad \text{where } a \text{ is a positive constant.}$$

What value of r maximizes the speed?

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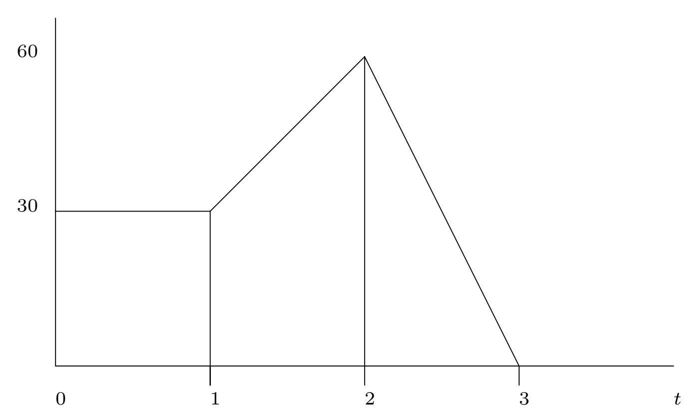
(8) (10 points) The velocity, v in miles per hour, of a car as a function of time, t in hours, is given by the following graph.



(a) How far does the car travel in the first two hours? ____________________

(b) If the car starts 100 miles form Columbia, and moves directly away from Columbia, then how is it from Columbia after 3 hours? ____________________

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(9) (10 points) An oil tank springs a leak. The rate R the oil is coming our of the tank is given by the following table:

t (minutes after the leak starts)	0	5	10	15
R (gallons / minute)	10	8	7	6

Give upper, lower, and best guess estimates, of the total amount of oil that has leaked out in the first 15 minutes of the leak.

Upper ______________________

Lower ______________________

Best Guess ______________________

(10) (10 Points) Find the area between the curves $y = 4x^3$ and $y = x^4$.

Area is ______________________