

Mathematics 122 Final

Name: _____

You are to use your own calculator, no sharing.**Show your work to get credit.** This means that if you use your calculator to solve a problem, then you have to write a sentence telling how you used it to do the calculations. (That is if you graphed it and zoomed in then say that is what you did etc.)

(1) (20 points) Find the following antiderivatives

(a) $\int (3x^4 + 5x^3 - 4x^2 + 4x - 7) dx =$

(b) $\int (e^u + \pi^3) du =$

(c) $\int \left(\sqrt{t} + \frac{2}{t} \right) dt =$

(d) $\int 4e^{3q} dq =$

(2) (10 points) If $Q'(r) = 12r^2 - 4r + 3$ and $Q(1) = 3$ then find $Q(r)$.

$Q(r) =$ _____

- (3) (10 points) For the function $f(x) = x^2e^{-x}$ find the critical points and classify as to being local maximizers or minimizers.

Critical points: _____

Local maximizers: _____

Local minimizers: _____

- (4) (10 points) Corresponding values of x and y are given by the table:

x	1	4	7	10	11
y	3	1	-1	-3	-5

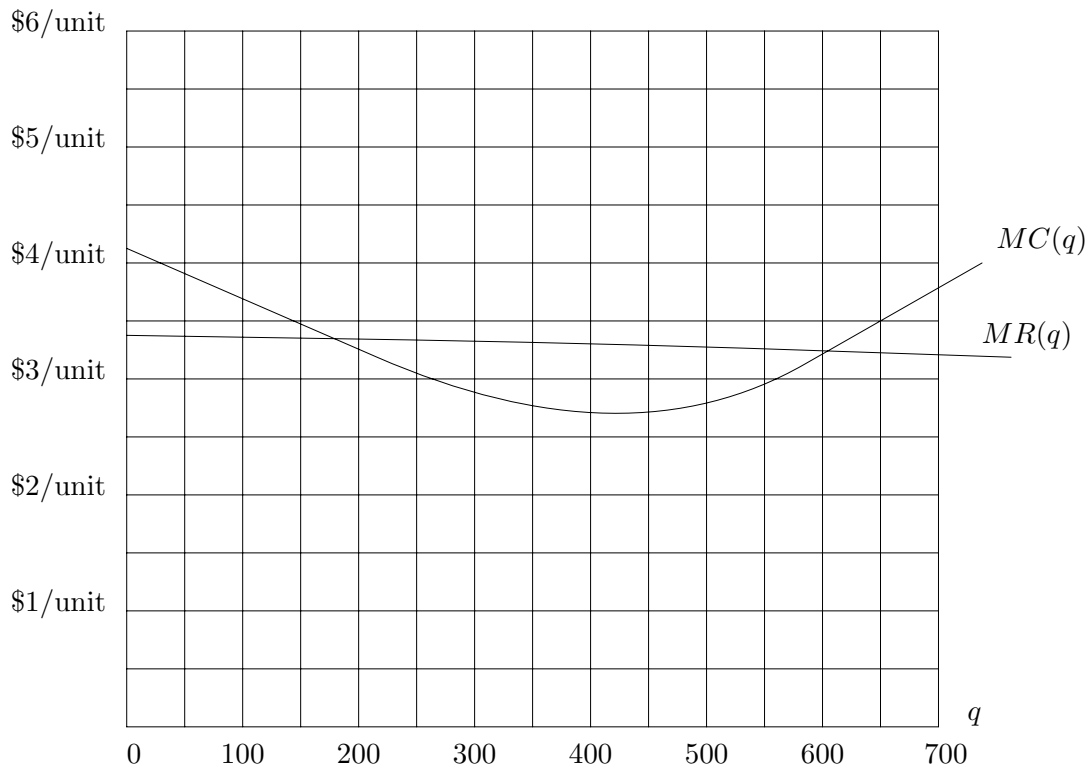
Assuming that the relationship between p and q is linear answer the following:

- (a) Find x as a linear function of y .

- (b) Find y as a linear function of x .

- (c) What is the value of y when $x = 20$?

- (5) (10 points) The graph below shows the marginal cost $MC(q)$ and the marginal revenue $MR(q)$ of producing q units some product.



- (a) At the point $q = 100$ is the marginal profit positive or negative? Briefly explain why.

- (b) For what value of q is the profit maximized?

- (6) (5 points) What is the effective annual yield of a money invested at 18% if

- (a) It is compounded monthly?

- (b) It is compounded continuously?

(7) (10 points) Let a function $f(t)$ be given by the table

t	1	3	5	7
$f(t)$	3.2	4.4	5.9	7.5

(a) Approximate the derivative at the points 2, 4, 6.

t	2	4	6
$f'(t)$			

(b) Is the second derivative $f''(t)$ positive or negative? Explain your answer.

(c) Estimate $f(5.7)$

$f(5.7) \approx$ _____

(8) (10 points) Ten roaches get into a dorm. Assume the population of roaches grows exponentially and that after 2 months there are 200 roaches in the dorm.

(a) Give a formula for the number $R(t)$ of after t months.

$R(t) =$ _____

(b) What is the doubling time for the population of roaches in the dorm?

(c) How long before there are a million roaches?

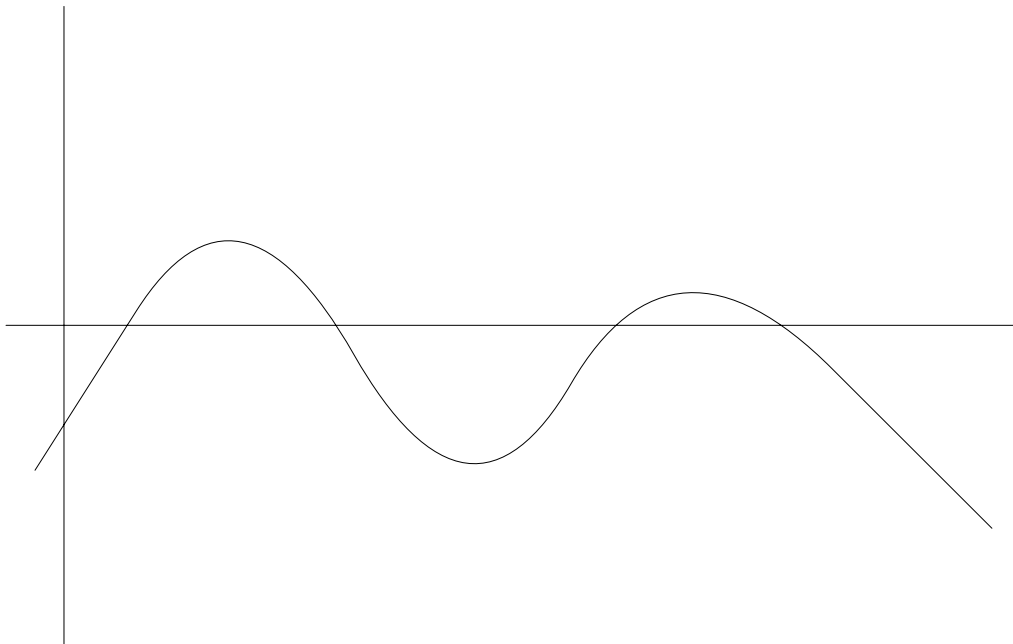
(9) (5 points) Draw Graphs of functions that satisfy the following:

(a) Is increasing and concave down.

(b) Has $f'(x) < 0$ and $f''(x) > 0$

(c) Has $f''(x) < 0$ and $f'(2) = 0$.

(10) (5 points) For the function given by the following graph sketch a graph of the derivative on the same set of axis.



(11) (5 points) Sketch the graph of a function $y = f(x)$ so that

- $f'(x) > 0$ for $x < -1$,
- $f'(x) < 0$ for $-1 < x < 2$,
- $f'(x) > 0$ for $2 < x$,
- $f(-1) = 4$, and
- $f(2) = 0$

(12) (10 points) Compute the following using your calculator

(a) $\int_0^2 \frac{1+x^2}{4-x} dx =$

(b) $f'(1.5)$ where $f(x) = 3(1.41)^{2x}$. $f'(1.5) =$ _____

(13) (5 points) A function $f(t)$ has values given by the table:

t	1.0	1.5	2.0	2.5	3.0
$f(t)$	7.1	7.4	8.0	8.6	9.0

Estimate $\int_1^3 f(t) dt$.

$\int_1^3 f(t) dt \approx$ _____

(14) (20 points) Compute the derivatives of the following functions (no simplification required):

(a) $T(r) = \frac{3}{r^2} - 5\sqrt{r}$

$T'(r) =$

(b) $f(x) = 3x^2 e^{x^3+x}$

$f'(x) =$

(c) $f(x) = 4 \ln(x^2 + 1)$

$f'(x) =$

(d) $Q(s) = \frac{s+1}{2s+1}$

$Q'(s) =$

(15) (5 points) Find the area between the curves $y = x^3$ and $y = \sqrt{x}$.

Area = _____

(16) (10 points) What is the tangent line to $y = x^2 + 2x - 1$ at the point where $x = 3$?

(17) (10 points) The marginal cost of producing a text book is $MC(q) = 20 + e^{-q/50}$ dollars/book where q is the number produced. If the startup costs for producing the books are \$100.00 dollars, then what is the cost of producing 500 books?

(18) And for Christmas: **Five free points.**

Have a nice holiday.