Math 118 - Final Exam

Spring 2017

Last Name: _____

First Name: _____

Signature: _____

Instructions:

- Unless otherwise indicated, please clearly show all of your work. Correct answers without justification may not receive credit.
- You may use a simple scientific calculator with no graphing functions. No other electronics are permitted for use. In particular, cell phones must be turned **off** and stored away.
- You may use one double-sided 8.5-by-11-inch formula sheet, written in your own handwriting. No computer printouts or photocopies allowed. You must put your name on your formula sheet and hand it in, tucked behind this cover page.
- No other notes or books may be used.
- **Circle your section below:**

Blois 9 am Wolcott 11 am Tiruviluamala 2 pm	Blois 10 am Toulisse 12 pm	Wolcott 10 am Zillinger 1 pm

Question	Points	Score
1	8	
2	10	
3	8	
4	10	
5	10	
6	8	
7	15	
8	15	
9	16	
Total:	100	

8 1. The cost for producing q rooster clocks (for former farmers adjusting to city life) per week is given by the following function:

$$C(q) = \frac{2}{3}q^3 - 8q^2 + 230q + 432,$$

(a) What is a formula for your marginal cost?

(b) If the revenue for selling q rooster clocks is given by $R(q) = 270q$, how many units should you produce? Why?

10 2. A car is driving on the road and suddenly notices an obstacle 600 feet away and immediately starts slowing down. The car's **velocity** in ft/s measured every two seconds is given in the table below

t	0	4	8	12	16
v	60	44	28	12	0

(a) Roughly when does the car come to a stop?

(b) Give an upper and a lower estimate for the distance travelled between $t = 0$ s and $t = 16$ s. Justify your answer.

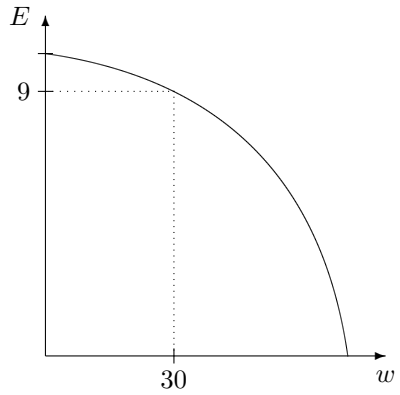
(c) Based on your results, which of the following statements can you make? Please explain your answer briefly below.

A. The car hits the obstacle.

B. It does not hit the obstacle.

C. We can not tell from just the given data.

8 3. A cement truck driver notices that the fuel efficiency of her truck E (measured in miles per gallon, mpg) is a function of the weight of the load she is carrying w (measured in tons). She suspects that the graph of E against w has the shape shown below.

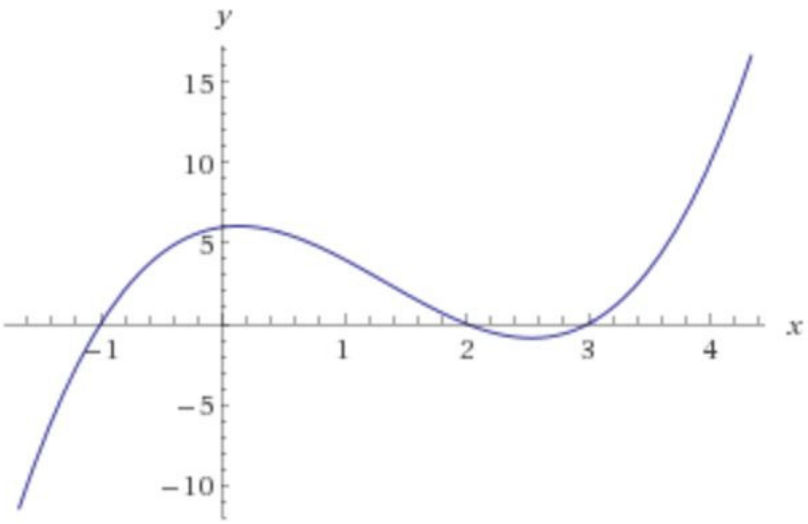


(a) Suppose that when $w = 30$, $E' = \dfrac{dE}{dw} = -0.21$. What does this tell us in practical terms? Be as precise as you can.

(b) Use the derivative in (a) to estimate the fuel efficiency of her truck when she is carrying 33 tons. Remember to include units in your answer.

(c) Is your estimate in (c) an underestimate or an overestimate? Explain.

10 4. Consider the following graph



(a) Where are the inflection points of $f(x)$ if the graph shows the function $f''(x)$?

(b) Where are the inflection points of $f(x)$ if the graph shows the function $f'(x)$?

(c) Where are the inflection points of $f(x)$ if the graph shows the function$f(x)$?

10 5. Find the (x, y)-coordinates of the global extrema of the function $f(x) = 3x^4 + 4x^3 - 12x^2 + 6$ for $-1 \leq x \leq 2$.

8 6. You just won the CA State lottery, and now you're given two different options for redeeming your prize:

- **Option 1:** A continuous income stream which pays a rate of \$10 000 per year, for 10 years, directly deposited in your bank account.
- **Option 2:** A lump sum of \$ 50 000 deposited into your bank account .now.

Your bank account pays 5% of interest per year, compounded continuously.

(a) What option should you choose if you want to have more money?

(b) Suppose that the lottery commission offers a third option: a continuous income stream of k dollars per year, paid over 10 years, to be deposited into your savings account paying 5% of interest compounded continuously. If k is chosen so that this income stream is worth exactly the same as the lump sum of \$50 000 paid today (and also deposited in the same savings account), what can you say about k?

A. k is less than \$5 000.

B. k is equal to \$5 000.

C. k is larger than \$5 000.

15 7. Calculate the following integrals:

(a) $\int_0^1 (x^3+2)^3 x^2 \, dx$

(b) $\int_1^2 \frac{x^3+7x+2}{x} \, dx$

(c) $\int x^2 \ln(x) \, dx$

15 8. Catty Scratches Beauty Supplies Inc. produces two colors of claw polish for cats: Revolutionary Red and Stealthy Sapphire. The demand equations are

$$q_R = 150 - 2x - y$$
$$q_S = 200 - x - 3y$$

where x and y are the prices per bottle of red and sapphire claw polish respectively, and q_R and q_S are the numbers of bottles of red and sapphire claw polish demanded per month.

(a) Express Catty Scratches' monthly revenue R as a function of x and y only.

(b) Find all critical point(s) of the revenue function and classify each as a local maximum, local minimum, or a saddle point. If possible, advise Catty Scratches as to how much they should charge for each color of claw polish in order to maximize their revenue.

16 9. Compute the following integrals.

(a) $\int_0^2 \int_0^1 ye^{yx}\ dxdy$

(b) $\int_{-1}^1 \int_{-1}^1 (xy + 2y)\ dxdy$