UNIVERSITY OF REGINA
Department of Mathematics and Statistics
Math 102-001,002 Final Exam, Fall 2014

Time: 3 hours Pages: 7 Name:_____

Instructor: ☐ P. Maidorn (001) Student Number:_____
(please indicate) ☐ L. MacKnight (002)

Show all required work, explaining necessary steps. Use the back of each page if sufficient space is not available. Use scrap paper for rough work, and do not hand it in.

1. Solve each equation or inequality: *[18 marks]*

a) $x^2 + x - 12 = 0$

b) $|x - 4| < 3$

c) $x^3 - 4x^2 - 7x + 10 = 0$

d) $\dfrac{2x}{x+1} = \dfrac{2x-1}{x}$

e) $\cos(x) = -\dfrac{1}{2}$

f) $\log_2(x+2) + \log_2(x-1) = 2$

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2. The monthly cost of driving a car depends on the number of kilometers driven. Andy found that in May his driving cost was $380 for 480 kilometers and in June his cost was $460 for 800 kilometers. Assume there is a linear relationship between the monthly cost C (in $) and the distance driven x (in km). *[12 marks]*

a) Use this information to construct the linear function $C(x)$.

b) Use the function to find the cost in September if Andy drove 950 miles.

c) If Andy has a monthly budget of $600 for his car, how many kilometers would he be able to drive each month?

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3. The stray-cat population in a small town is growing exponentially. In 2009, the stray-cat population was 60. In 2014, the stray-cat population has grown to 130. *[12 marks]*

a) If the population N after t years is modeled by the function $N(t) = 60e^{kt}$, where t is measured in years after 2009, find the growth constant k.

b) Find the project stray-cat population in the year 2020.

c) In what year is the stray-cat population projected to reach 500?

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4. The profit P (in $) of producing and selling x items is given by the function

$$P(x) = -1500 + 12x - 0.0004x^2$$ *[9 marks]*

a) What is the profit or loss of producing and selling 4000 items?

b) What is the maximum profit that can be obtained? Find both the required production level (x) and the actual maximum profit (P). Show all work.

5. A girl is lying on the beach, flying a kite. She holds the end of the kite string at ground level, and estimates the angle of elevation of the kite to be 50^o. If the string is 140m long, how high is the kite above the ground? *[6 marks]*

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6. Given the function $f(x) = 3x - x^2$, evaluate and simplify the expression for *[8 marks]*

a) $f\left(-\frac{3}{4}\right) =$

b) $\frac{f(1+x) - f(1)}{x} =$

7. Consider the function $f(x) = \frac{6x^2 + 5x - 2}{x^2 - 3}$ *[10 marks]*

State: The domain: _____

All x- and y-intercepts: _____

Symmetry (even/odd/neither): _____

Use this space for work:

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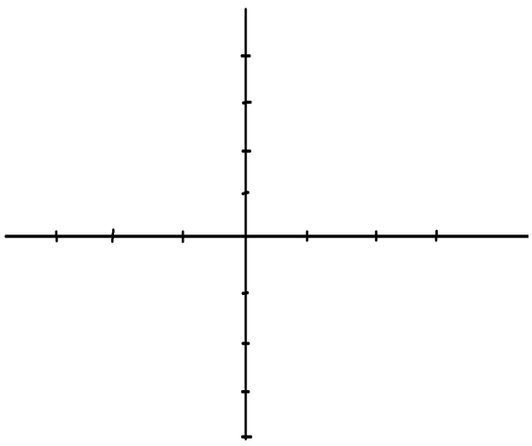
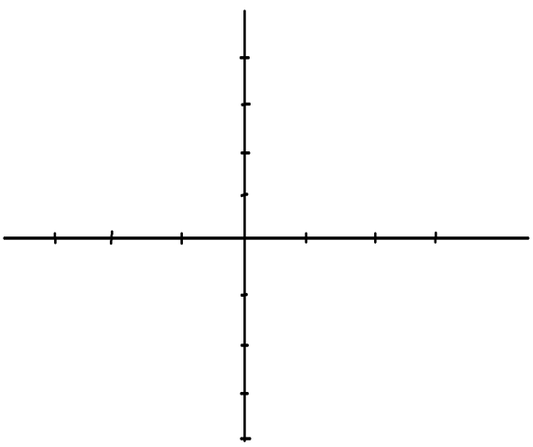
8. Sketch graphs of the each equation: *[9 marks]*

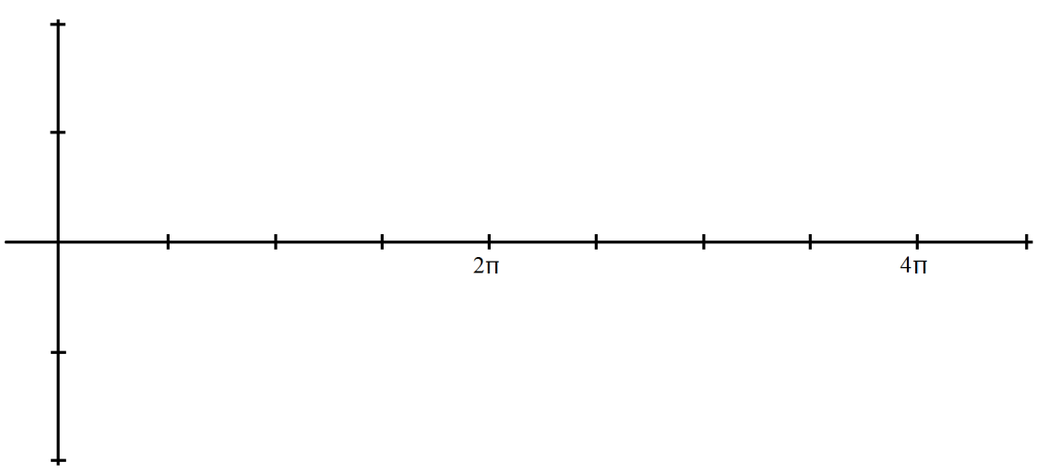
a) $y = 3 - 2x$



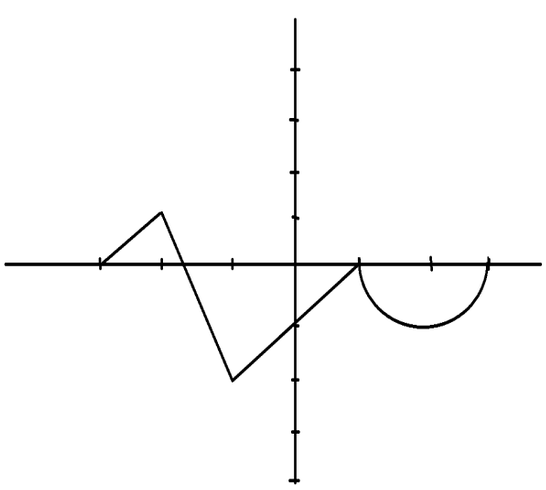
b) $(x-1)^2 + (y+1)^2 = 9$

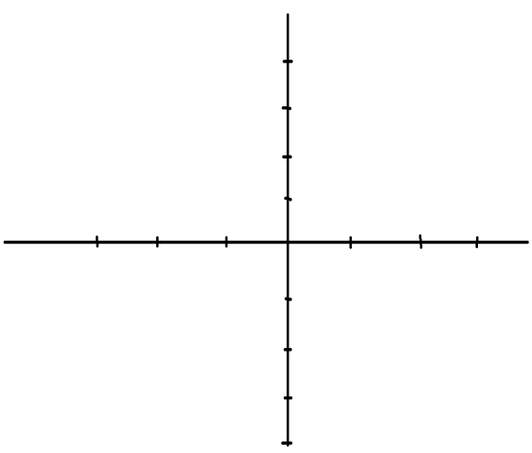


c) $y = 1 - \sin(x)$ (show the graph from $x = 0$ to $x = 4\pi$)



9. Given the graph of the function $y = f(x)$, sketch a graph of $y = 2f(x-1)+1$ *[6 marks]*





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10. Consider the polynomial $f(x) = x^4 - 7x^3 + 15x^2 - 9x$.

One root is given as x=1. Use long division to find and classify (single, double,...) all roots of the polynomial. Then use the information to sketch a graph of the function.

[10 marks]