MTH3051-2

Algebraic and Graphical Modelling

Pretest A

Adult Booklet

Name of student	Student Number
Name of teacher	Date of Birth
Center	Date of exam
School Board	Result

INSTRUCTIONS FOR THE EXAM

This exam has 2 sections :

- Section A - Evaluation of explicit knowledge
- Section B Evaluation of competencies

Instructions

- Always show your steps for solving the problems with clear indications of calculations.
- Make sure that you clearly identify different variables when ever necessary.
- Ask the exam supervisor for scrap paper if you need it. This paper will be destroyed at the end of the exam session.

- At the end of the exam session hand in this booklet and scrap paper to the exam supervisor.
- A passing mark is an overall mark of 60 %.
- A mark of 0 will be given to any answer that no steps are shown.

Autorised Material

- Your memory aid that has been approved by your teacher.
- A scientific or graphing calculator with a cleared memory.
- A ruler, a set square, a compass, a protractor and clean graph paper.

Duration

- 3 hours

Section A - Evaluation of knowledge
On the exam, this section is worth 20 % of the final mark

Question 1

At 1:05 PM a plane starts it's, decent for landing and the pilot makes a note of the plane's altitude at three different times. The graph below shows his observations. If the plane continues to descend at the same rate as shown on the graph determine the time that the plane will land.

Altitude of the Plane as a function of time

Altitude (meters)

10000

7750

4750

1   4   8   Time (minutes)
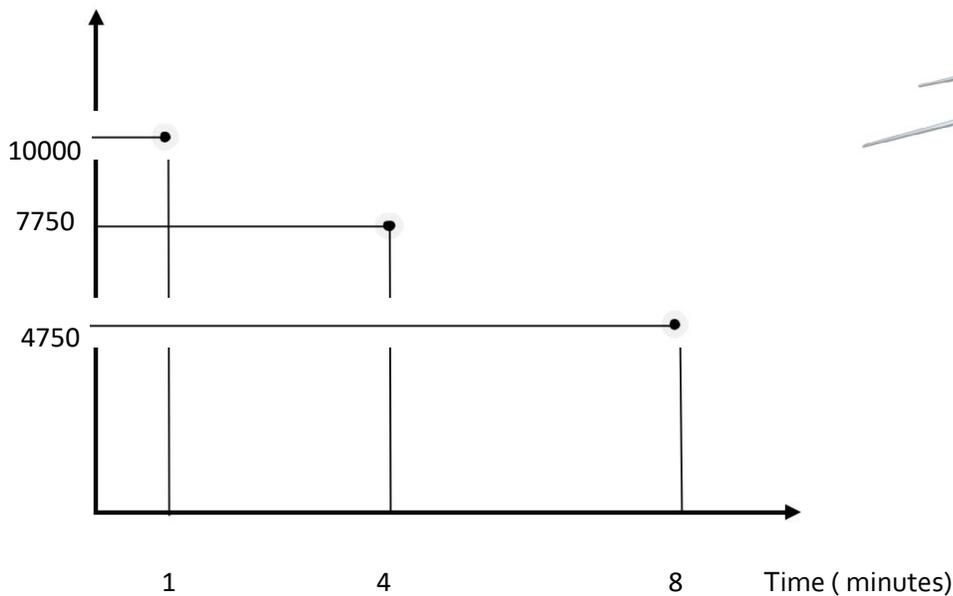
Steps :

Question 2

Pierre and Sophie want to wash their car and decide to go to a car wash that is self serve. The cost of using the car cleaning tools (brush, pressure washer,…) is calculated as shown below :

Lave-Auto Qualité Pro

Fixed fee : 2.00$

User fee : only 0.50$/minute

- Pierre would like to know how much it will cost them to wash their car as a function of the time it takes.
- Sophie is more interested in how much time they will have to wash the car according to the amount of money that they have.
- Determine the algebraic model that will answer their individual questions and identify the dependant and independent variables.

Algebraic model for Pierre

Algebraic model for Sophie

Question 3

Solve the following problems:

a) Solve the system of equations below
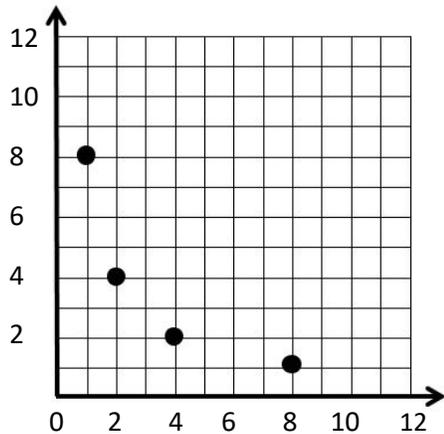
   1) $y = - - x + 11$

   2) $x + 6y = 30$

b) Solve the inequality below

   $4 (0,75x + 500) \geq -1600 + 12x$

Question 4

Match (if possible) by drawing a line from the functions on the left to the ordered pairs on the right. More that one ordered pair can be matched with the same function.

| x	f(x)
-2	-30
0	-26
3	-20
6	-14
10	-6

f(x)= ✳

A museum charges 16.00$ for one entry ticket valid for one day.

We are interested in the cost of the museum visit as a function of hours spent at the museum.

$f (20) = 14$

$(16 , 0.5)$

$f^{-1} (16) = 0.5$

$f (24) = 20$

$(16 , 6)$

Question 5

Eric used his car several times today. The graph below represents the variations in temperature of the motor at different times of the day.

Temperature of the motor as a function of time
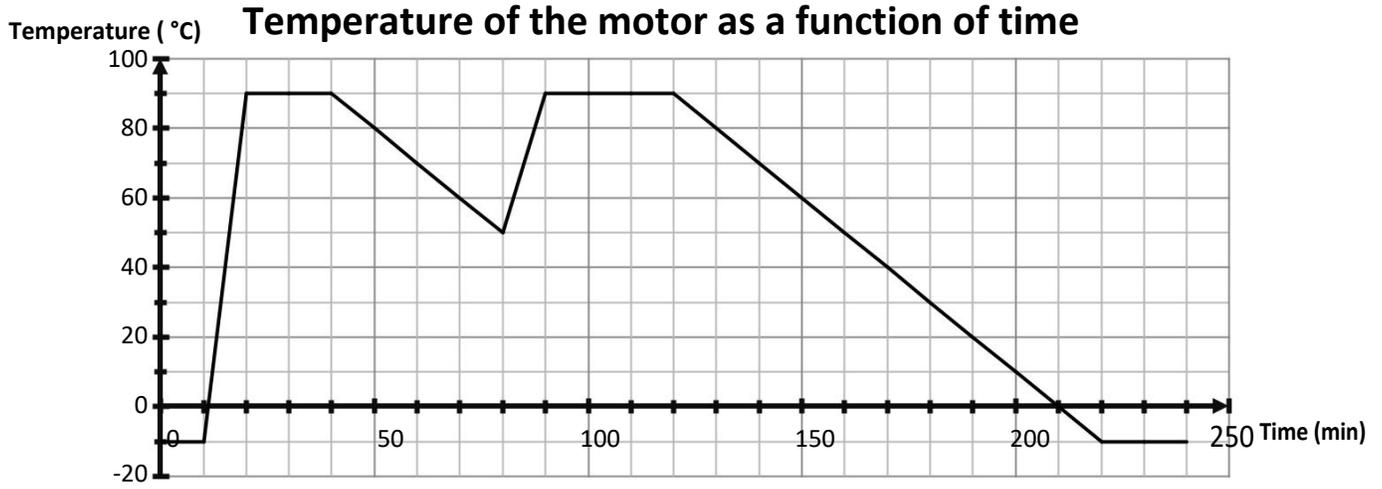
a) Complete the table below:

Properties	Interval	Significance of this
Domaine		
Range		
Decreasing		
Increasing		
Constant		
Y-intercept		
X-intercept		
Minimum		
Maximum		

b) How long was the motor running ? _____

Task 1

You work as a chef in the kitchen of a five star gourmet restaurant. It is 4:00PM and you are asked to prepare a roast beef that weighs around 1kg for some special guests. You check your recipe book and find the following information about cooking roast beef:

In an oven at 170°C (325°F), the internal temperature of a 1kg roast beef will go up 0,6°C per minute (0,6°C/min), or according to this formula :

$F = 0,6\ t + D$ where

F : Final internal temperature (at the end of cooking time (°C))
t : cooking time in minutes
D : Initial internal temperature (at the beginning of cooking time (°C))

	Internal Temperature (Celcius)
Rare	55°C
M-rare	60°C
Medium	65°C
W-Done	70°C

a) Draw a graph representing internal temperature of roast beef as a function of time if your roast comes from a refrigerator (at a temperature of 4 °C) and if the total cooking time is 120 minutes.
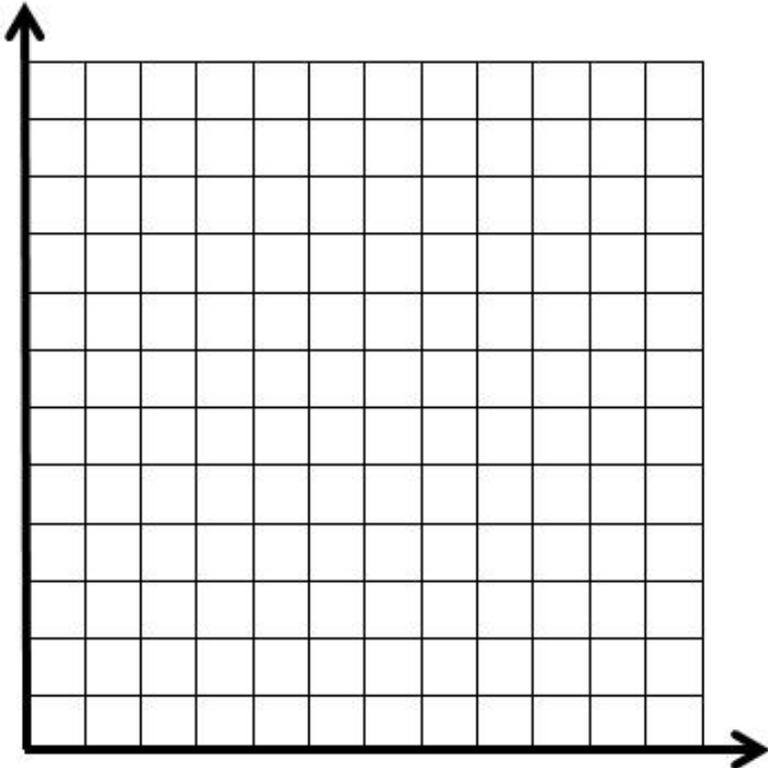
b) If the guests want their roast medium and plan to arrive at 6:00 PM, what time do you have to put the roast in the oven to be ready at that time?

c) Your boss calls you to tell that the guests will arrive at 5:20 PM instead of 6 :00 PM and he wants the roast to ready at that time. In a panic, you think of the following 2 solutions to reduce the cooking time:

     <u>Solution 1</u> : Increase the temperature of the oven to 190°C (375°F) which would increase the cooking speed of the from 0,6°C/min à 0,7°C/min. You don't want to raise the oven temperature any higher than that because you worry that if you do, the meat might get dry.

     <u>Solution 2</u> : Keep the oven at the same temperature 170°C (325°F) and use another roast beef (prepared for another customer) that is presently at room temperature (20°C).

What impact will each solution have on the graph that you drew in a) and what solution will you choose? Justify your answer with mathematical arguments.

Impact of solution 1 on your graph: _____

                                     _____

                                     _____

Impact of solution 2 on your graph: _____

                                     _____

                                     _____

<u>Solution Choice :</u>

Task 2

Steve is 23 years old and looking for work as a mechanic. He is trying to decide whether he should stay in Quebec and work for Autoplus (a car dealership) or go back to his country of origin, France and work for Paris-Auto Garage.

- Autoplus has offered him a starting salary of 26000$ with a raise of 1500$ per year.

- Paris-Auto Garage has offered him a salary according to this table :

Years of experience	Annual Salary in euros (€)
0	20000 €
1	20900 €
2	21800 €
3	22700 €
4	23600 €
5	24500 €
Etc …..	….

If exchange rate is 1 euro = $1.45 Canadian, he wonders which job is most advantageous for him. Which job offers the highest salary and will it be that way right up until his retirement? Justify your answer with mathematical arguments.
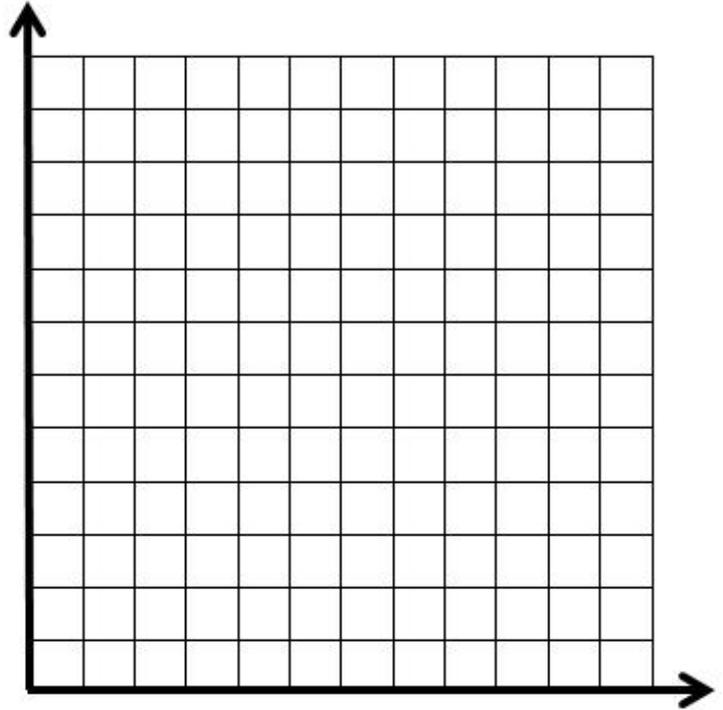
Task 3

Sophie wants to visit her grandfather who lives 50 km from her house. She wonders how long if will take her to get there depending on the speed that she drives her car.

a) Determine an algebraic model that will help her figure this out and draw the graph.
   Reminder : Speed is a function of distance and time

Algebraic model :

b) Sophie usually drives at a speed of 95 km/h when she goes to her grandfather's house. She would like to make the trip faster this time. What speed should she drive if she wants to arrive there 15 minutes earlier and if she wants to arrive there 30 minutes earlier, what speed is required?

c) Finally, Sophie decides to drive at a speed of 117 km/h. This increased speed will definitely cost her more in fuel consumption. The reason for this is because when a car moves faster the wind resistance is stronger which results in higher fuel consumption. The table below shows her car's fuel consumption at different speeds:

Speed	Fuel Consumption
60 km/h	5,2 L/100km
80 km/h	6,6 L /100km
100 km/h	8,0 L/100km

Note : L/100km indicates the number of liters of gasoline necessary to cover a distance of 100 km.

Assuming that this trend continues, determine the additional cost of fuel for Sophie when she drives faster than her usual speed. In the area where Sophie lives, 1 liter of gas costs $1.20.