Pretest DA

MTH-4151

1. The following table contains the equations for nine straight lines.

Line	Equation
L1	$x - ½ = 3x/5$
L2	$y = 5$
L3	$y = -x/3 + 1/3$
L4	$x = y/3$
L5	$-x + y/3 + 5/3 = 0$
L6	$4x + 2 = 0$
L7	$y = 3x - 5$
L8	$y + 3 = 2y/3$
L9	$y = 5x - 3$

For each pair of lines below, state their relationship (parallel and distinct, parallel and coinciding, perpendicular or intersecting, non-perpendicular). In each case, justify your answer with slopes and, if necessary, with x- and y-intercepts.

a) L1 and L6
b) L3 and L4
c) L2 and L7
d) L4 and L7
e) L6 and L8
f) L5 and L7
g) L2 and L8
h) L3 and L9

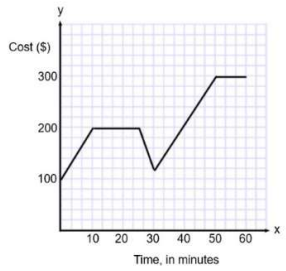
2. Graph the following function in the interval [2,5[

$y = 3(2.5)^x$

3. Graph on the same plane the following functions in the interval]-1,1]

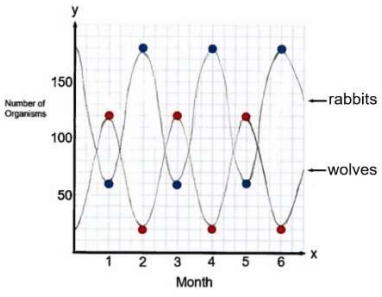
$y = -3x^2$ and $y = ½ x^2$

4. Use the following graph to answer:



a) Domain
b) Range
c) Maximum
d) Minimum
e) y-intercept
f) Increasing interval(s)
g) Decreasing interval(s)
h) Interval in which the function reaches its maximum

5. The following graph shows how wolf populations rise and fall as a reaction to rabbit populations on a large uninhabited island in the far north. Use the graph to answer the questions.



a) How many wolves are present at 12 months?
b) What is the increasing interval of rabbits between the 29^{th} and 31^{st} months?
c) What is the value of f(25) for the rabbits?
d) What is the minimum of the function in the interval [9,10] for the wolves?

6. In a lab, two different gases are isolated in closed containers, and then the pressure inside the containers is gradually reduced, in order to make the temperatures drop. Their results for the first few minutes are shown in the table below: (10 marks)

# of Minutes	Temperature of Gas 1	Temperature of Gas 2
2	16	6.2
4	12	2.4
6	8	-1.4
8	4	-5.2
10	0	-9
12	-4	-12.8
14	-8	-16.6

a) After how many minutes will the temperature of Gas 1 start to be lower than the temperature of Gas 2?

b) What is the interval during which the temperature of Gas 1 is higher?

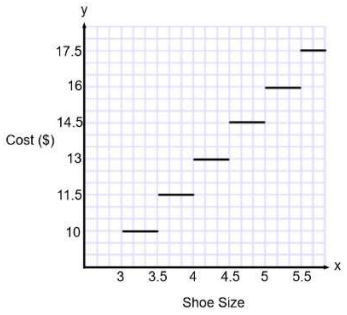
7. (20 marks) My house is next to a farm which has a tall grain silo. My swimming pool has the same radius as the silo, and both pool and silo are cylinders. I start filling my pool with water at the same time that the farmer starts pouring grain into the silo.

Below is a table of values that shows the height in cm of water in the pool and the height in cm of grain in the silo, both as a function of time, in hours.

Time (hours)	Height of Water (cm)	Height of Grain (cm)
3	0.72	0.16
4	1.28	0.32
5	2	0.64
6	2.88	1.28
7	3.92	2.56
8	5.12	5.12
9	6.48	10.24
10	8	20.48

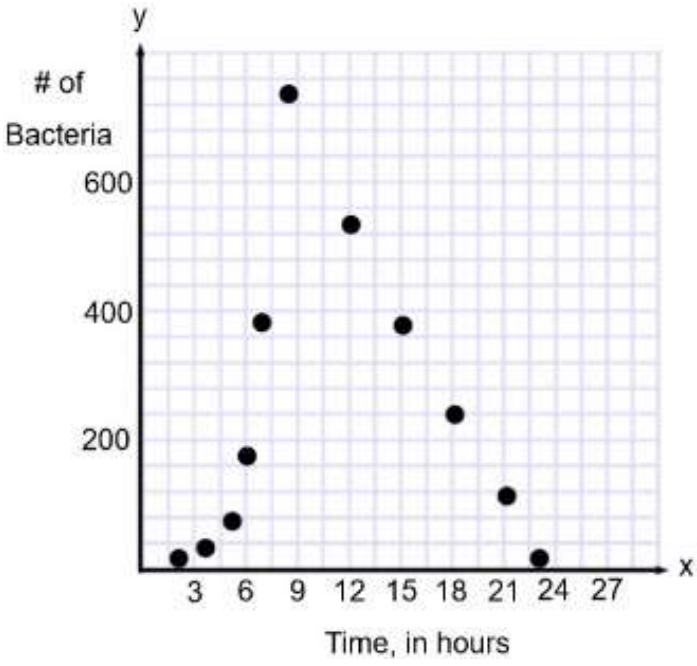
a) Derive the equation for both functions.
b) If the pool is full when the water is 1.4m deep, how long will this take?
c) The silo is full after 18 hours. How tall is the silo?
d) When will the grain's height be 20 times the water's height?

8. (10 marks) My child needs special skates for a new type of hillside speed skating. The laces are sold separately and cost $3. The prices of the skates depend on the child's shoe size, and are illustrated in the graph below:



If my child's feet are size 12½, and my entire purchase is subject to a 9.975% sales tax, what is the total amount I will have to pay?

9. (10 marks) I grew a colony of bacteria in a petri dish as a science experiment. Their numbers increased until the power went out, at which point it became too cold in the lab. The following graph shows how many bacteria were living on my Petri dish, as a function of time, in hours.



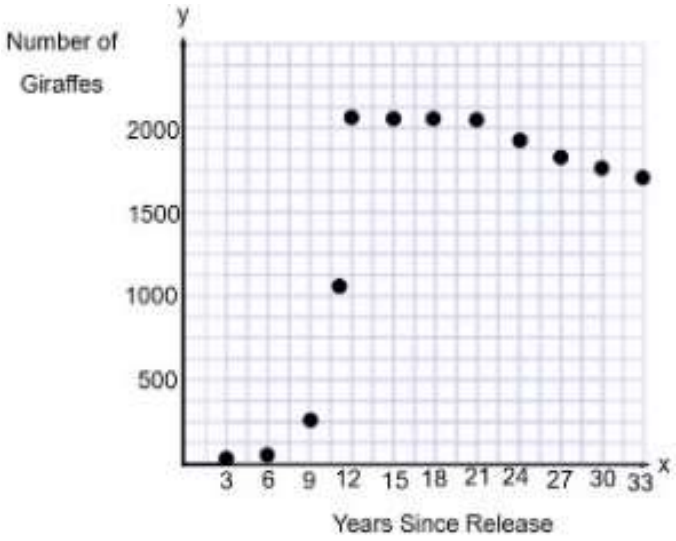
Determine how many bacteria were living on the petri dish after 7 hours, and after 19 hours.

You must use algebra to solve this problem, which in this case means determining an algebraic model, and plugging values into the functions you determined, in order to get the values needed to answer the final question.

10. (10 marks) After winning the lottery I bought an island to live on. The island had no mammals larger than a mouse. I decided to introduce a small breeding herd of giraffes, and then I analyzed their population. At first, the population increased rapidly, as the giraffes colonized all of the suitable areas of the island. Then the high population density caused epidemics of common giraffe diseases to spread, causing a decline in their numbers. But the numbers were still too high and they were going to deplete their food resources, so I introduced a breeding group of tigers. The number of giraffes declined further.

    The following table and graph shows giraffe numbers as a function of the number of years since I first bought the island:

# of Years	# of Giraffes	# of Years	# of Giraffes
3	4	21	2024
6	32	24	1950
9	256	27	1874
11	1024	30	1801
12	2024	33	1727
15	2020		
18	2028		

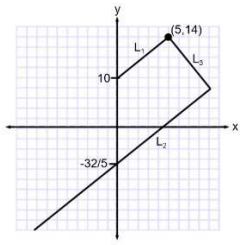


    Create an algebraic model using the fewest functions possible, to represent this data. Then test your model with the 3 additional points in the following table:

# of Years	# of Giraffes
5	16
17	2018
31	1808

    How reliable is your model?

11. (10 marks) L_1 and L_2 are both perpendicular to L_3.



a) What is the difference between the x-intercepts of L_1 and L_2?

b) What is the difference between the y-intercepts of L_2 and L_3?