YEAR 11 GENERAL MATHEMATICS INVESTIGATIVE TASK 4

Linear graph applications

Question 1

A factory manufactures pencil cases which sell for $5.00 each. The production cost is made up of an initial cost of $4000 and an extra $1.00 per pencil case. Let x be the number of pencil cases produced.

a The cost of producing x pencil cases is C. Find an expression for C in terms of x.

[1 mark]

b What is the cost of producing 250 pencil cases?

[1 mark]

c The revenue from selling x pencil cases is R where revenue is equal to the selling price per pencil case multiplied by the number of pencil cases sold. Find an expression for R in terms of x.

[1 mark]

d What is the revenue from selling 250 pencil cases?

[1 mark]

e The profit P made from selling x pencil cases is equal to the revenue minus the cost.

i Does the manufacturer make a profit by producing and selling 250 pencil cases? Justify your answer.

ii How many pencil cases must be produced and sold for a profit to be made?

[2 + 2 = 4 marks]

f **i** Find a rule that gives the profit for producing and selling x pencil cases.
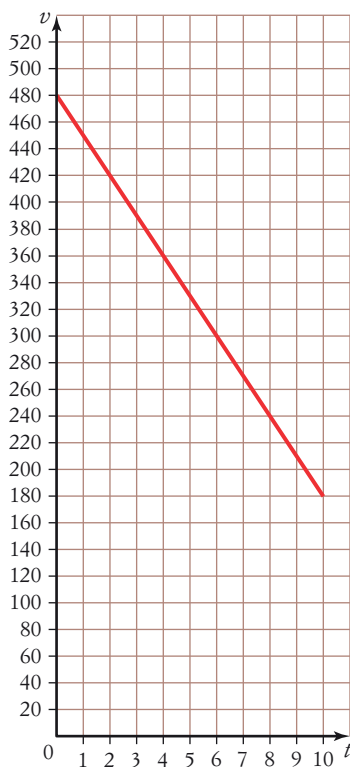
[2 marks]

ii How many pencil cases must be sold for a profit of $5000 to be made?

[2 marks]

[Total 12 marks]

Question 2

The Rambaldis have a water tank in their yard. The tank has sprung a leak and water leaks from the tank at a constant rate. The graph below shows the volume V litres remaining in the tank after t hours for the first 10 hours.

a How many litres of water were initially in the tank?

[1 mark]

b How many litres of water are left in the tank after 6 hours?

[1 mark]

c How many litres of water had leaked from the tank after 4 hours?

[1 mark]

d How many litres of water were leaking from the tank each hour?

[1 mark]

e Find a rule which gives the volume remaining in the tank, V litres, after t hours.

[2 marks]

f How long would it take for the tank to empty if water continues to leak at the same rate?

[2 marks]

g After 10 hours the rate at which the water leaks changes to 10 litres per hour due to a piece of debris partially blocking the hole.

  i Find an expression for the volume remaining in the tank at time t hours for $t \geq 10$.

ii How long does the tank take to empty from when the debris blocks the hole?

[3 + 2 = 5 marks]

[Total 14 marks]

Question 3

Ari and Julian are at opposite ends of a 30 metre straight street. They start walking towards each other at the same time. Ari walks at 1 metre per second and Julian walks at 2 metres per second.
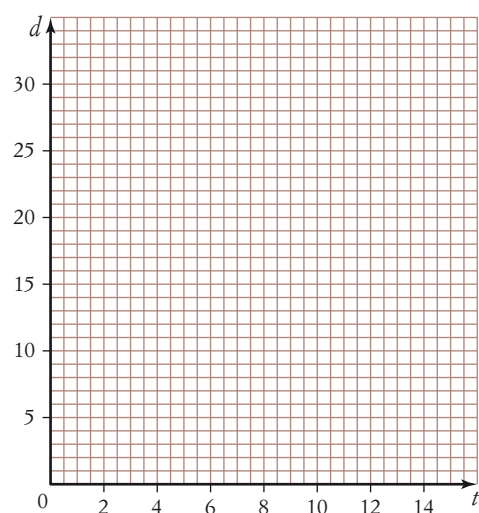
Let d be the distance from Julian's starting point.

a Complete the table of values to show the distance of each boy from Julian's starting point.

Time (seconds)	0	2	4	6	8	10
d, Julian						
d, Ari						

[3 marks]

b On the same set of axes, plot a graph of distance, d, against time, t, for each boy.

[4 marks]

c Use the graph to find when the two boys are level with each other.

[1 mark]

d Find a relationship between d and t for each boy.
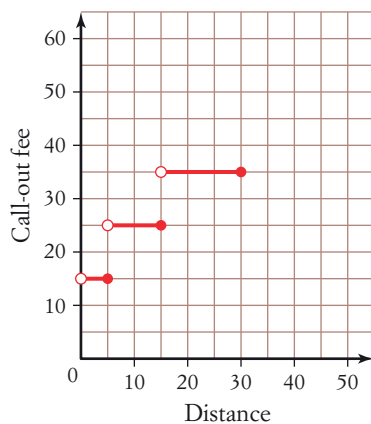
[3 marks]

e After how many seconds walking does Julian reach the other end of the street?

[1 mark]

[Total 12 marks]

Question 4

James is an electrician. The call-out fee that he charges depends on the distance he has to travel to do a job. The graph below shows the call-out fees, in dollars, for distances up to 30 kilometres.

a i What is the call-out fee to travel a distance of 25 km?

[1 mark]

ii What is the maximum distance that James will travel for a call-out fee of $15?

[1 mark]

b One day James has three jobs. The first involves travelling a distance of 28 km. For the second job he travels 15 km and for the third job he travels 20 km. What is the total call-out fee that he charges for the three jobs?

[2 marks]

c James charges a call-out fee of $50 to travel distances more than 30 km but less than or equal to 45 km. Draw this information on the graph above.

[1 mark]

James starts a week with 60 litres of fuel in his petrol tank. After travelling 100 km there were 40 litres of fuel remaining in his tank.

The amount of fuel left in James' tank follows a linear trend.

d Find an equation connecting the amount of fuel remaining in the tank, *f*, and the distance travelled, *d*.

[2 marks]

e How much **further** would James be able to travel before the tank is empty?

[2 marks]

[Total 9 marks]

Question 5

Cara and Marcus set out on a hike from Sandy Beach to rainbow falls, a distance of 25 kilometres.

Cara walks at a constant speed of 5 km/h for the entire hike and takes no rest stops.

a i How far does Cara walk in 2 hours?

[1 mark]

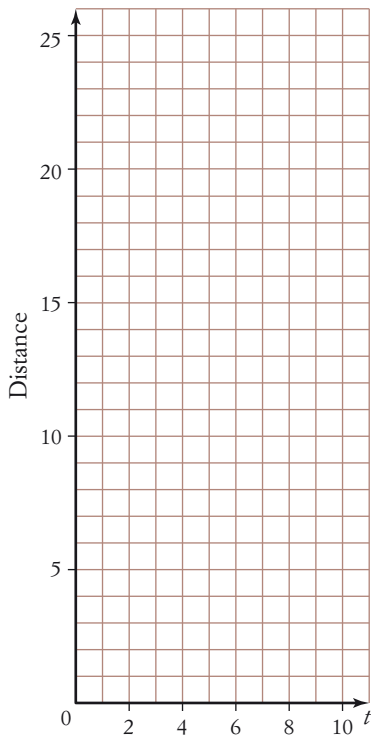 **ii** How long does it take for Cara to complete the hike?

[1 mark]

b The distance of Cara from Sandy Beach, in kilometres is given by $d_c = kt$ where *t* is the time in hours since she began walking and *k* is a constant.

  i Write down the value of *k*.

[1 mark]

ii Sketch a graph of d_c against t on the set of axes below. Clearly label the coordinates of the endpoint.

[2 marks]

Marcus starts walking at the same time as Cara hikes along the same track. He starts walking at a speed of 6 km/h but after two hours he notices that he is slowed down blisters on his ankles and slows to walk at 2 km/h.

c Let d_m represent the distance walked by Marcus after t hours. Draw a graph of d against t on the graph above. Label the coordinates of any end point.

[2 marks]

d The piecewise function below gives the distance walked by Marcus d_m at time t hours after starting the hike.

$$d_m = \begin{cases} nt, & 0 \le t \le a \\ mt + c, & a \le t \le b \end{cases}$$

Find the values of n, a, m, t and b.

[5 marks]

e After how many hours walking does Cara overtake Marcus?

[2 marks]

[Total 15 marks]