2.1 Linear Functions & Graphs

Question Paper

Course	DP IB Maths
Section	2. Functions
Topic	2.1 Linear Functions & Graphs
Difficulty	Medium

Time allowed: 100

Score: /76

Percentage: /100

Question 1a

The equation of a line l_1 is $2x - y + 6 = 0$.

(a) For the line l_1, find:

(i) the y-intercept

(ii) the x-intercept

(iii) the gradient.

[3 marks]

Question 1b

A new line, l_2, intersects the x-axis at $(4, 0)$ and is perpendicular to l_1.

(b) Find:

(i) the gradient of the line l_2

(ii) the equation of the line l_2. Give your answer in the form $ax + by + d = 0$, where a, b and d are integers.

[3 marks]

Question 2a

The coordinates of point A are $(2, 8)$ and the coordinates of point B are $(-8, 2)$. M is the midpoint of [AB].

(a) Find the coordinates of M.

[2 marks]

Question 2b

l_1 passes through A and B.

(b) Find the gradient of l_1.

[2 marks]

Question 2c

(c) Find the equation of the line l_1. Give your answer in the form $ax + by + d = 0$, where a, b and d are integers.

[3 marks]

Question 3a

The coordinates of point A are $(1, 7)$ and the coordinates of point B are $(5, 5)$. M is the midpoint of [AB].

(a) Find the coordinates of M.

[2 marks]

Question 3b

The line l_1 passes through the points A and B.

(b) Find the equation of l_1. Give your answer in the form of $y = mx + c$.

[2 marks]

Question 3c

A new line, l_2, is the perpendicular bisector to l_1.

(c) Find the equation of l_2. Give your answer in the form of $y = mx + c$.

[3 marks]

Question 4a

Plumber A charges a fixed fee of $25 plus $15 per hour.

(a) Using t for the number of hours a job takes, and C_A for the total cost of a job, in dollars, from Plumber A, write down an equation connecting t and C_A.

[2 marks]

Question 4b

A job takes the plumber seven hours.

(b) Calculate the total cost of the job.

[2 marks]

Question 4c

Plumber B charges a fixed fee of $20 plus $16 per hour.

(c) Using t for the number of hours a job takes, and C_B for the total cost of a job, in dollars, from Plumber B, write down an equation connecting t and C_B.

[2 marks]

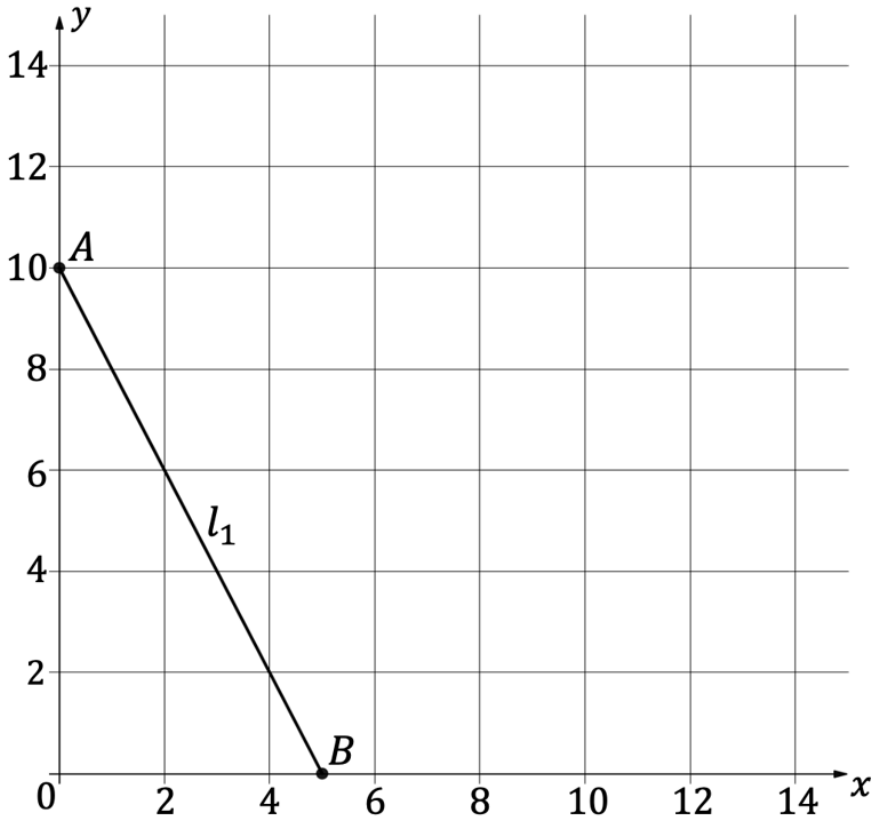
Question 4d

(d) Determine which plumber would be the cheapest for a job taking six hours.

[3 marks]

Question 5a

The diagram below shows the line l_1, which intersects the y-axis at A$(0, 10)$ and the x-axis at B$(5, 0)$.



(a) Find the equation of l_1. Give your answer in the form of $y = mx + c$.

[2 marks]

Question 5b

(b) Find the length of [AB].

[2 marks]

Question 5c

A second line, l_2, is parallel to l_1 and intersects the x-axis at C$(8, 0)$.

(c) Find the equation of l_2. Give your answer in the form $ax + by + d = 0$, where a, b and d are integers.

[2 marks]

Question 5d

(d) Where does l_2 intersect the y-axis?

[1 mark]

Question 6a

Photocopy shop A charges \$122 for 115 copies, and \$190 for 200 copies.

(a) Assuming a linear relationship, find

(i) the price for 180 copies

(ii) how many copies could be made for \$385.20.

[4 marks]

Question 6b

Photocopy shop B charges $0.82 per copy and a fixed fee of $25.50.

(b) State which photocopy shop is cheaper to make 220 copies.

[3 marks]

Question 7a

A family can be supplied with electricity by two companies that have different pricing structures:

Company A: Fixed fee of $25/month and $0.2 per kWh consumed.
Company B: Fixed fee of $10/month and $0.22 per kWh consumed.

(a) Determine the equation of the cost function for both companies, where the total monthly cost y is a function of the monthly electricity consumption x in kWh.

[2 marks]

Question 7b

(b) Calculate the monthly energy consumption that results in the same monthly cost from both companies.

[4 marks]

Question 8a

Ardie's monthly expenditure, $C(x)$, is a linear function of his monthly income, x. Ardie's monthly expenditure is \$1000 when his monthly income is \$1200 and his monthly expenditure increases by \$60 for every \$150 increase in his monthly income.

(a) Write an expression connecting Ardie's monthly expenditure, $C(x)$, with his monthly income, x.

[2 marks]

Question 8b

(b) Calculate Ardie's monthly expenditure when his monthly income is \$1885. Give your answer to the nearest dollar.

[2 marks]

Question 8c

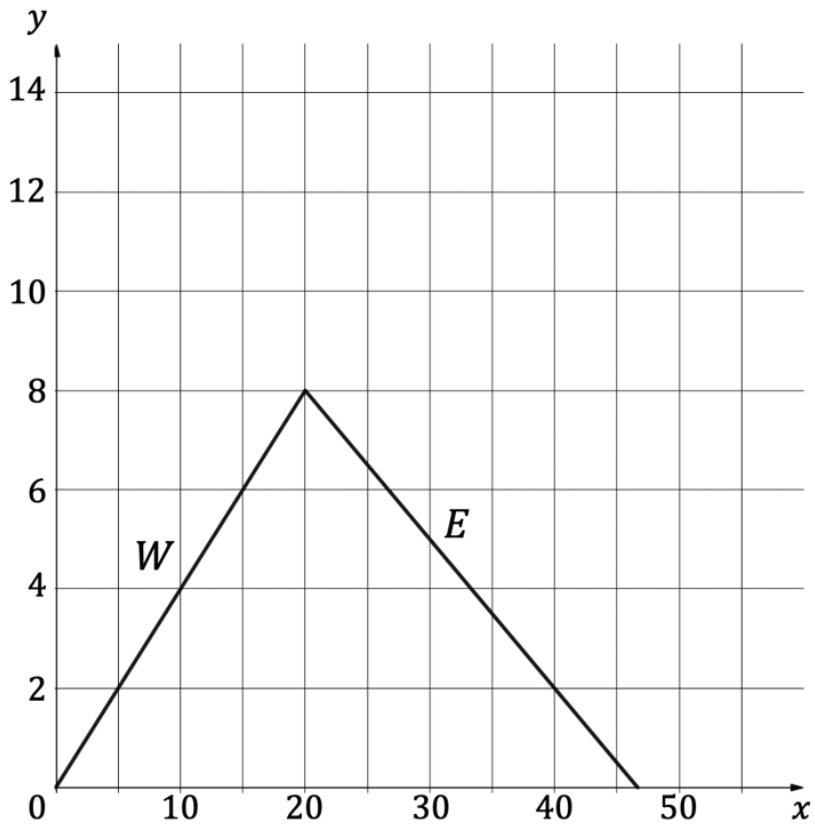
(c) Find Ardie's monthly income when his monthly expenditure is $1070. Give your answer to the nearest dollar.

[2 marks]

Question 9a

The diagram below represents a mountain with a west facing slope and an east facing slope labelled W and E respectively.

Horizontal scale: 1 unit represents 100 m.
Vertical scale: 1 unit represents 100 m.



(a) Find the gradient of the west facing slope.

[1 mark]

Question 9b

The gradient of the east facing slope in the diagram is $-\frac{3}{10}$.

(b) Find the total distance to hike over the mountain in km.

[6 marks]

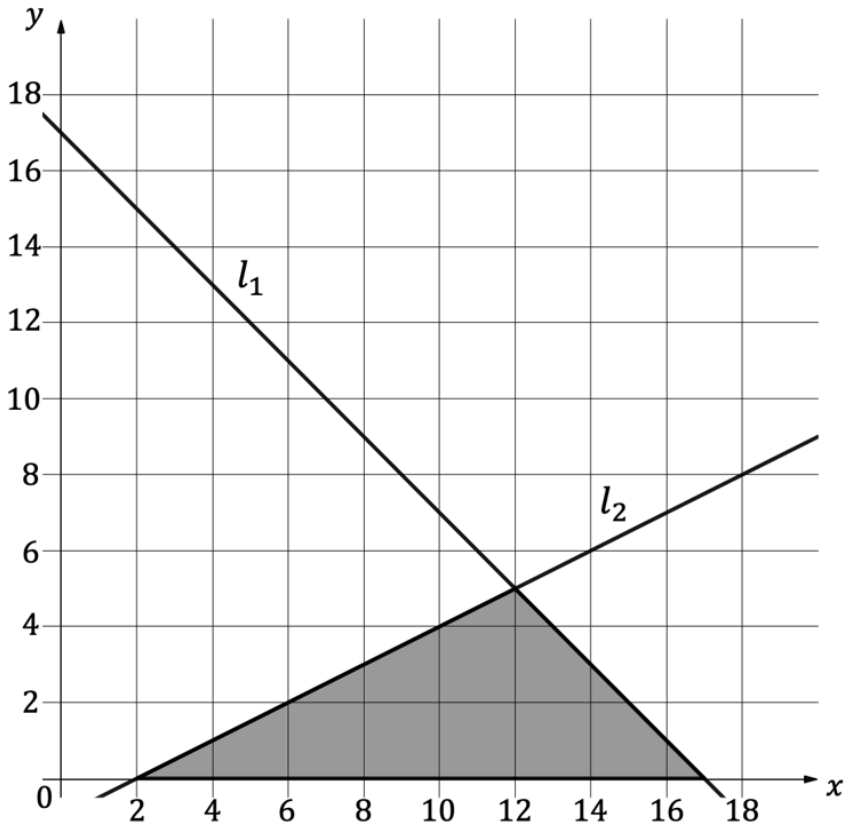
Question 9c

(c) Suggest a reason as to why the actual total distance hiked may be greater than the distance found in part (b).

[1 mark]

Question 10a

The straight lines l_1 and l_2 are shown in the diagram below l_1 intercepts the x-axis at $(17, 0)$ and the y-axis at $(0, 17)$ and l_2 intercepts the x-axis at $(2, 0)$ and the y-axis at $(0, -1)$.



(a) Giving your answer in the form $y = mx + c$, find:

(i) the equation of l_1

(ii) the equation of l_2.

[4 marks]

Question 10b

(b) Find the area of the shaded region.

[4 marks]

Question 11a

A line passing through the origin O, is perpendicular to a line with equation $x + y = 16$. The two lines meet at point R. P is a point such that $OP : PR = 3 : 1$.

(a) Find the equation of the perpendicular line and hence, the co-ordinates of point R.

[3 marks]

Question 11b

(b) Find the coordinates of P.

[2 marks]