2.1 Linear Functions & Graphs

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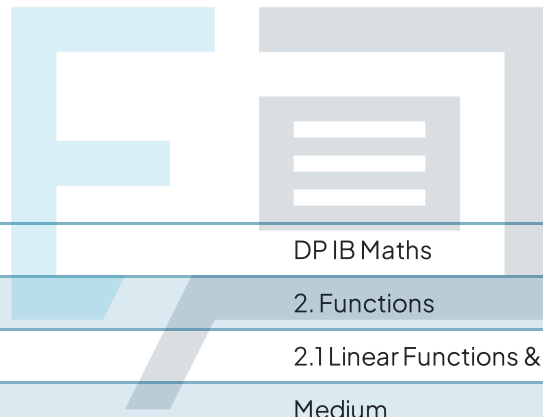
Course	DP IB Maths
Section	2. Functions
Topic	2.1 Linear Functions & Graphs
Difficulty	Medium

To be used by all students preparing for DP IB Maths AA SL
Students of other boards may also find this useful

Question 1a

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

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.

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 $[AB]$.

Find the coordinates of M.

[2 marks]

Question 2b

The line l_1 passes through A and B.

Find the gradient of l_1.

[2 marks]

Question 2c

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 $[AB]$.

Find the coordinates of M.

[2 marks]

Question 3b

The line l_1 passes through the points A and 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.

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.

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.

Calculate the total cost of the job.

[2 marks]

Question 4c

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

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.
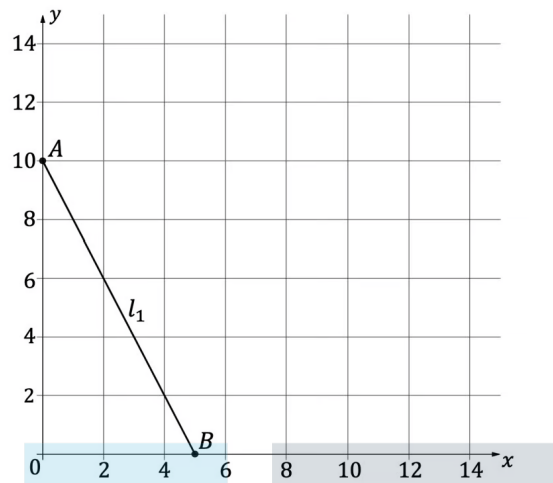
[2 marks]

Question 4d

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$(5,0)$.

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

[2 marks]

Question 5b

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$(8,0)$.

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

Find the coordinates where l_2 intersects the y-axis.

[1 mark]

Question 6a

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

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.

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.

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

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.

Write an expression connecting Ardie's monthly expenditure, $C(x)$, with his monthly income, x.
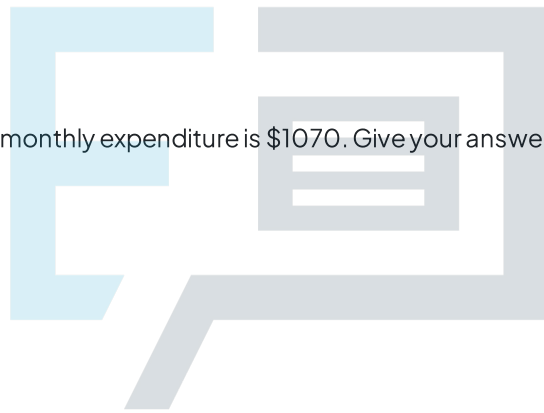
[2 marks]

Question 8b

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

[2 marks]

Question 8c

Find Ardie's monthly income when his monthly expenditure is $1070. Give your answer to the nearest dollar.
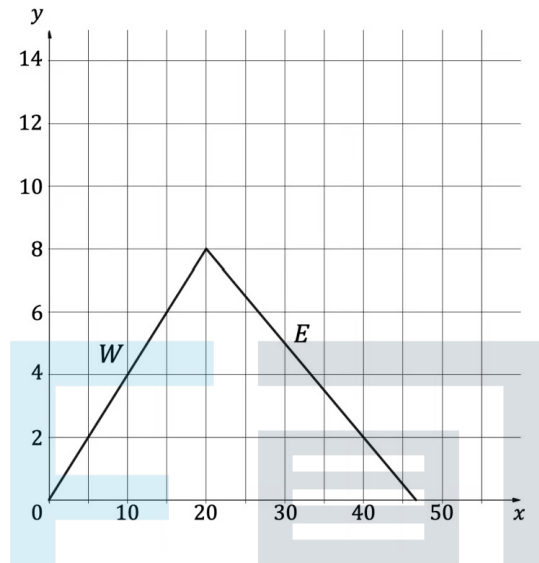
[2 marks]

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.

Find the gradient of the west facing slope.

[1 mark]

Question 9b

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

Find the total distance to hike over the mountain in km.
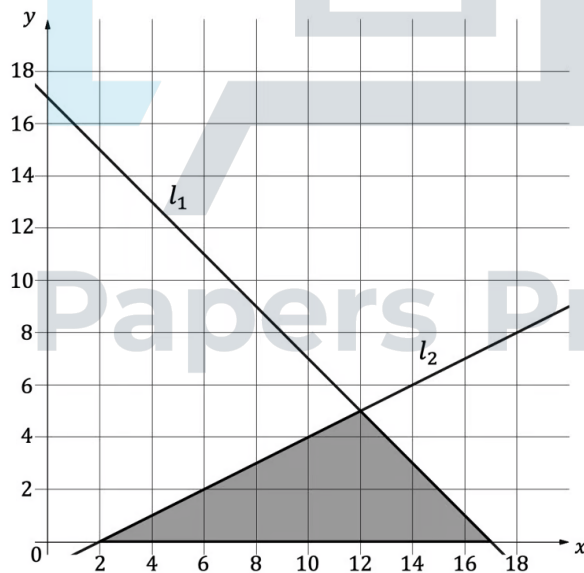
[6 marks]

Question 9c

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 $(0, -1)$.

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

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 $OP : PR = 3 : 1.$

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

[3 marks]

Question 11b

Find the coordinates of P.

[2 marks]