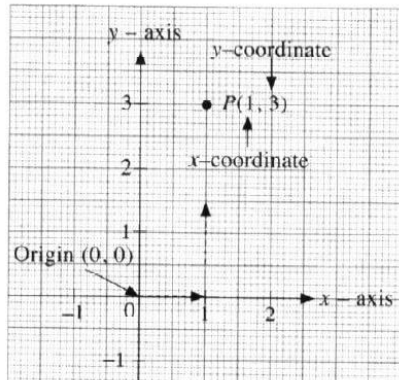# Sec 1 Math: Coordinates and Graphs

A) Basic Definitions

B) Equation of a line (* Important)

There are four main types of straight lines:
a) Horizontal lines (Left-right line, L_3)
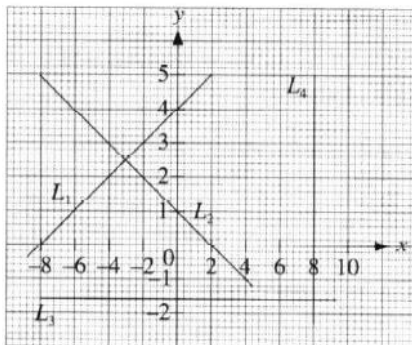Equation: $y = -1.6$

b) Vertical lines (Up-down lines, L_4)
Equation: $x = 8$

c) Diagonal lines (Slope down, L_2)
Equation: $y = -\frac{1}{2}x + 1$

d) Diagonal lines (Slope up, L_2)
Equation: $y = \frac{1}{2}x + 4$

C) Equation of a line

The general equation of a diagonal line is in the form:
$$y = mx + c$$

m is Gradient   **c is y-intercept**

Gradient (m) = $\frac{rise}{run}$ = $\frac{y_1 - y_2}{x_1 - x_2}$
y-intercept = value where line crosses the y-axis

The equation of Vertical lines is in the form :
$$x = k$$
where k is the value the line crosses the x-axis

The equation of Horizontal lines is in the form:
$$y = k$$
where k is the value the line crosses the y-axis
Note: Schools love to test students on equations of horizontal & vertical lines in sec 1

D) Understanding Equations (Intermediate)

The equation of a straight line is $y = \frac{3}{2}x - 5$
a) State the gradient of the line
b) State the y-intercept of the line
c) The point $A(m, 1)$ lies on the line, find the value of m.
d) The point $B(10, k)$ lies on the line, find the value of k.
e) Determine whether the point $C(6, 5)$ lies on the line.

a) Gradient of the line is $\frac{3}{2}$
b) y-intercept is -5
c) Since $(m, 1)$ lies on the line, we can substitute $x = m$ and $y = 2$ into the equation:
$y = \frac{3}{2}x - 5$
$(1) = \frac{3}{2}(m) - 5$
$6 = \frac{3}{2}m$
$m = 6 \div \left(\frac{3}{2}\right)$ => $m = 4$
d) Substitute $x = 10$ and $y = k$ into the equation:
$k = \frac{3}{2}(10) - 5$ => $k = 10$
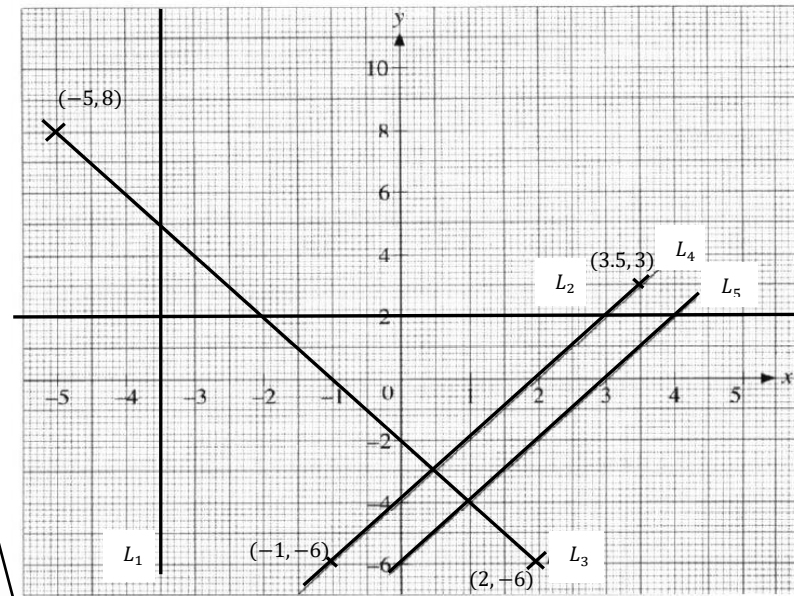e) Substitute $x = 6$ into the equation:
$y = \frac{3}{2}(6) - 5$
$y = 4$
When $x = 6$, $y = 4$, therefore $C(6,5)$ does not lie on the line.

E) Finding Gradient, y-intercept and Equation from Graph (Intermediate)

ai) Find the equation of line L_1 aii) What is the gradient of line L_1
bi) Find the equation of line L_2 bii) What is the gradient of line L_2
ci) Find the gradient of line L_4 cii) State the y-intercept of line L_4 ciii)State the equation of line L_4
di) State the equation of line L_5 e) Find the equation of line L_3

ai) Equation of L_1 is $x = -3.5$ aii) Gradient is undefined   (*Note: all vertical line gradients are undefined)
bi) Equation of L_2 is $y = 2$ bii) Gradient is 0   (*Note: all horizontal line gradients are zero)
ci) Gradient of $L_4 = \frac{y_1 - y_2}{x_1 - x_2} = \frac{3 - (-6)}{3.5 - (-1)} = 2$ cii) y-intercept is -4
ciii) Equation of L_4: $y = 2x - 4$

d) Gradient of L_5 = Gradient of $L_4 = 2$ (*Note: Parallel lines have same gradient)
y-intercept is -6 (Read from graph)
Equation of L_5: $y = 2x - 6$

e) Gradient $L_3 = \frac{8 - (-6)}{-5 - 2} = -2$ (*Note: Downward sloping lines have negative gradient)
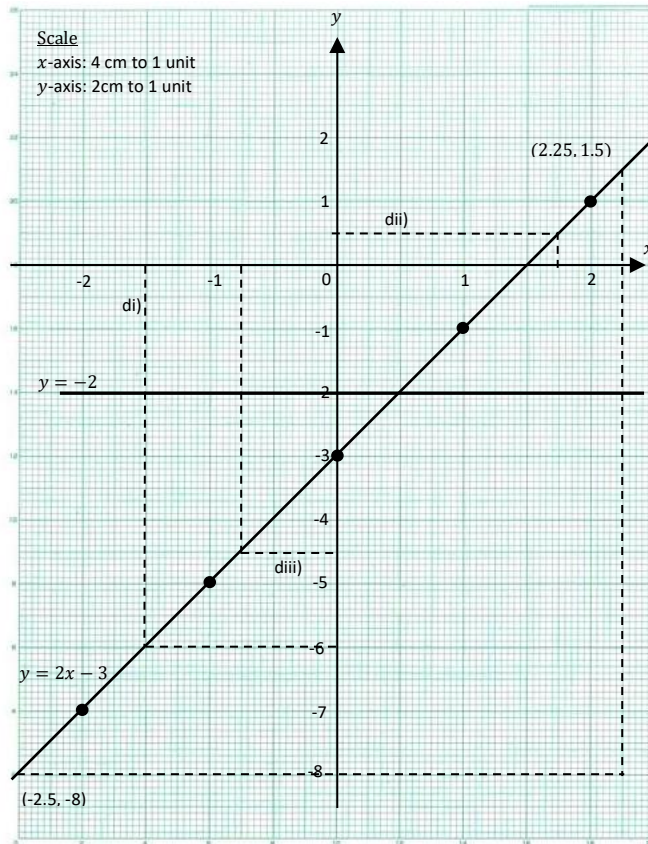y-intercept is -2 (Read from graph)
Equation of L_3: $y = -2x - 2$

F) Plotting Full Graph on Graph Paper

The table below shows some values of x and the corresponding values of y for which $y = 2x - 3$

x	-2	-1	0	1	2
$y = 2x - 3$	m	-5	n	-1	1

a) Find the values of m and n

b) Using a scale of 4 cm to represent 1 unit on the x-axis and 2 cm to represent 1 unit on the y-axis, draw the graph of $y = 2x - 3$ for $-2 \leq x \leq 2$.

c) Calculate the gradient of the graph.

d) From the graph, find
   i) the value of y when $x = -1.5$
   ii) the value of x when $y = 0.5$
   iii) the value of k given that the point $(k, -4.5)$ lies on the graph

e) On the same axes, draw and label the line $y = -2$.

f) From the graphs drawn, write down the coordinates of the point of intersection of the lines $y = -2$ and $y = 2x - 3$.

Scale
x-axis: 4 cm to 1 unit
y-axis: 2cm to 1 unit

(2.25, 1.5)

dii)

di)

$y = -2$

diii)

$y = 2x - 3$

(-2.5, -8)

(Back of Graph paper)

a) $m = 2(-2) - 3$
   $m = -7$

$n = 2(0) - 3$
$n = -3$

c) gradient $= \frac{y_1 - y_2}{x_1 - x_2}$
   $= \frac{1.5 - (-8)}{2.25 - (-2.5)}$
   $= 2$
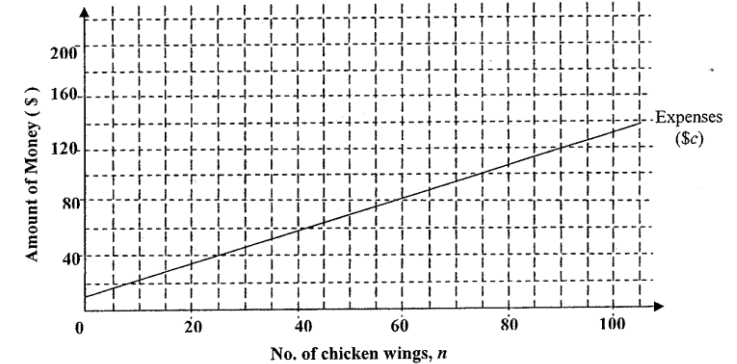
di) $y = -6$
dii) $x = 1.75$
diii) $k = -0.75$

f) $(0.5, -2)$

Note 1: Write scale in graph paper (especially if requested by school teacher)

Note 2: Remember to always label equations of lines drawn and label x-axis, y-axis

Note 3: dotted lines for question part d are required as it is part of the "working marks"

G) Graph Application

The graph below shows the cost of selling chicken wings at a fun fair

a) If Mr Au, the vendor has \$80, what is the maximum number of chicken wings he can prepare for selling?

b) If Mr Au wants to prepare 90 chicken wings to sell, how much money does he need?

c) The graph is represented by $c = An + B$, where \$$c$ represents Mr Au's cost and n represents the number of chicken wings he prepares.

i) State the value of B and explain its significance

ii) Calculate the value of A (round off to 2 s.f.) and explain its significance

a) From the graph, he can prepare 60 chicken wings (with \$80).

b) From the graph, he needs \$120 (to prepare 90 chicken wings)

ci) Value of B is 10 (Notice that B is the y-intercept of the equation/graph)
The value of B represents the <u>fixed cost</u> of selling chicken wings at the fun fair.

ii) Gradient $= \frac{120 - 40}{90 - 25}$
   ≈ 1.23077
   $= 1.2$ (2 s.f.)

$A = 1.2$ (Notice that A is the gradient of the equation/graph)
Its shows that the <u>cost of selling each chicken wing</u> is \$1.20

Understanding Equations (Intermediate)

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Finding Gradient, y-intercept and Equation from Graph (Intermediate)
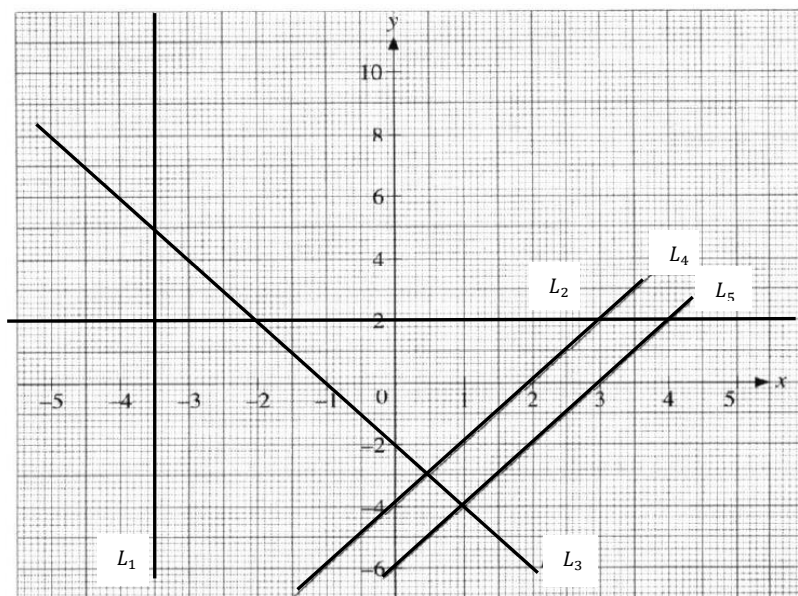
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ciii)State the equation of line L_4
d) State the equation of line L_5 　　e) Find the equation of line L_3

Graph Application
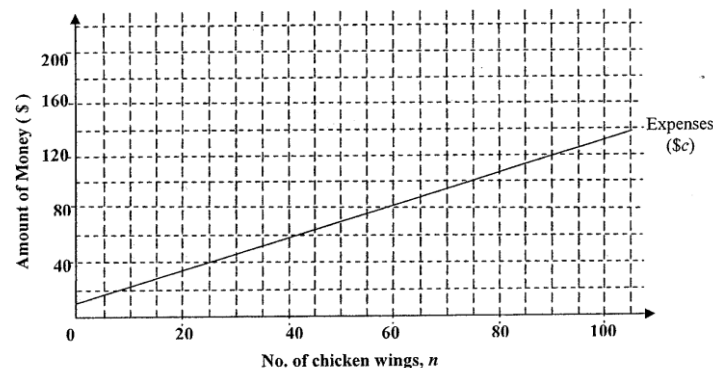
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