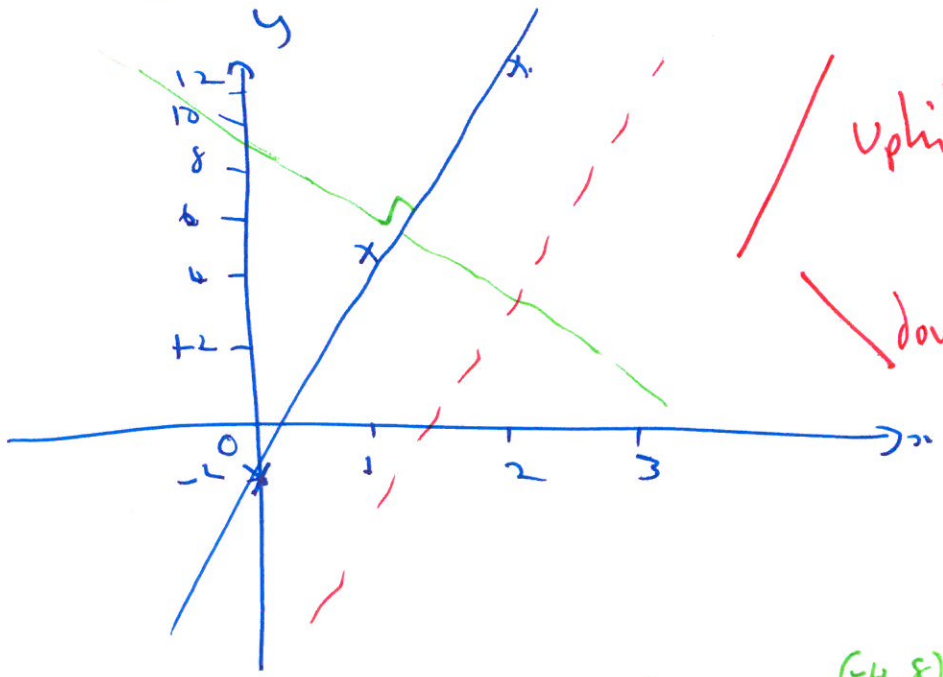
Equation of a Straight Line

$y = \frac{7}{1}x - 2$ ($\frac{7}{1}$: $-\frac{1}{7}$)

$y = mx + c$ — gradient; intercept on y axis

$x=1$	$y = 7\times1 - 2 = 5$	$(1, 5)$
$=2$	$y = 7\times2 - 2 = 12$	$(2, 12)$
$x=0$	$y = 7\times0 - 2 = -2$	$(0, -2)$



uphill +ve M

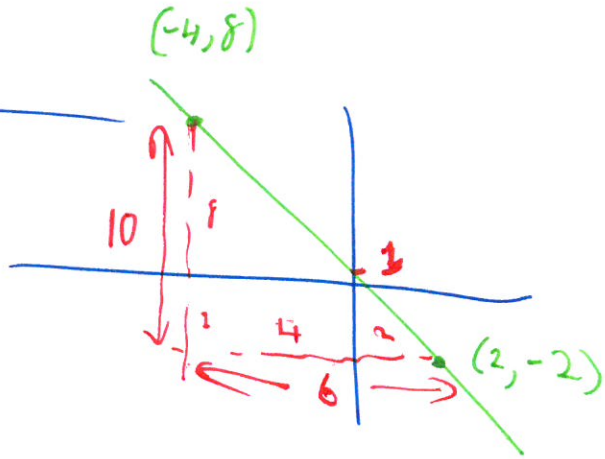
downhill -ve M

$3y = 4x + 6$

$-\frac{3}{4}$ → $y = \frac{4x}{3} + \frac{6}{3}$

$y = \frac{4x}{3} + 2$

$y = \frac{4x}{3} + 10$



$M = \frac{\text{diff in } y's}{\text{diff in } x's} = \frac{-10}{6} = -\frac{5}{3}$

$y = -\frac{5}{3}x + 1$

$+\frac{3}{5}$

1. Two different straight lines have the equations

$$y = 4x + 3 \quad \text{and} \quad 2y - 8x = 10.$$

Are these lines parallel? You must explain your answer. [2]

$y = 4x + 3$, gradient of 4

$2y - 8x = 10$

$2y = 8x + 10$

$\frac{y}{2} = \frac{8x}{2} + \frac{10}{2}$

$y = 4x + 5$, gradient of 4

So yes they are parallel they both have the same gradient.

2.

(a) (i) Use the graph paper below to draw the graph of $3x + 2y = 12$.

when $x = 0$, $2y = 12$, $y = 6$ $(0, 6)$

$x = 1$, $3 \times 1 + 2y = 12$ $(1, 4.5)$

$3 + 2y = 12$

$2y = 9$

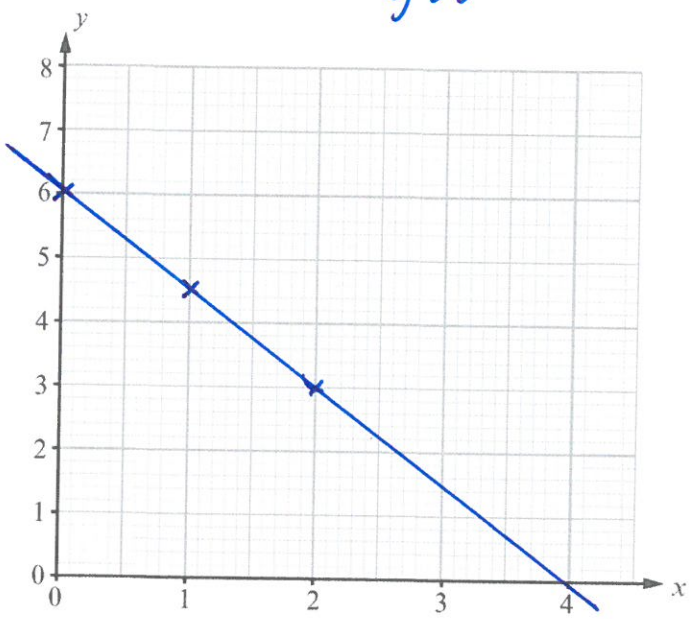
$y = 4.5$

$x = 2$, $6 + 2y = 12$ $(2, 3)$

$2y = 6$

$y = 3$

[3]



M2

A1

(ii) Write down the gradient of $3x + 2y = 12$.

$2y = -3x + 12$

$y = \frac{-3x}{2} + \frac{12}{2}$

gradient $= -\frac{3}{2}$

[1] B1

(b) Select from the following list of equations to complete the table below.

Equations:

A: $y + 4x = 3$ **B:** $y = 5x$ **C:** $y = 5x + 7$

D: $y - 3x = 4$ **E:** $x + y - 5 = 0$ **F:** $2y = 3x + 5$

Description	Equation
Passes through the origin (0, 0)	B
Parallel to $y = 3x + 7$	D
Intersects the y-axis at $y = 5$	E

A: $y = -4x + 3$ B: $y = 5x + 0$ C: $y = 5x + 7$

D: $y = 3x + 4$ E: $y = -x + 5$ F: $y = \frac{3}{2}x + \frac{5}{2}$

[3]

3.

Two of the equations below represent straight lines that are perpendicular to each other.

A: $4y = x$ B: $4y = 3x$ C: $3y = x$

D: $y = x$ E: $-4y = x$ F: $y = -4x$

Select the two equations that represent lines that are perpendicular to each other.
You must show by calculation that the equations represent perpendicular lines. [3]

A: $y = \frac{x}{4} = \frac{1}{4}x$ perp grad $= -4$

B: $y = \frac{3}{4}x$ perp grad $= -\frac{4}{3}$

C: $y = \frac{1}{3}x$ perp grad $= -3$

D: $y = 1x$ perp grad $= -1$ $-4 \times +\frac{1}{4} = -1$

E: $y = \frac{1}{-4}x$ perp grad $= +4$

F: $y = \frac{1}{4}$ $y = -4x$ perp grad $= +\frac{1}{4}$

perp lines are $4y = x$ and $y = -4x$

4.

Line	Equation
A	$y = 3x + 4$
B	$y = -3x + 3$
C	$y = -2x - 4$
D	$y = 3x - 5$
E	$y = 4x + 4$

(a) Which two of the above lines are parallel?
You must give a clear reason for your answer.

A & D because they both have the same gradient (3)

[2]

(b) Which two of the above lines intersect each other on the y-axis?

A & E

[1]

5. Select **two** of the following lines which are **perpendicular** to the straight line, *AB*, shown on the grid.
You must write a reason for your selections.

$y = \frac{3}{2}x + 8$

$2x + 3y = 8$

$3y = -2x + 8$

$2y = 3x + 6$

$y = \frac{-2x + 8}{3}$

$3y = 2x + 5$

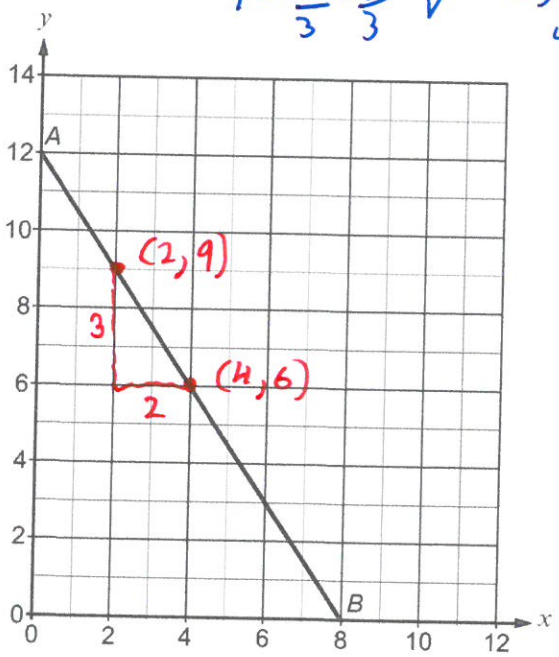
$y = \frac{2x}{3} + \frac{5}{3}$ ✓

$2x - 3y = 8$

$-3y = -2x + 8$

$y = \frac{-2x}{-3} + \frac{8}{3}$

$= +\frac{2}{3}x$



Reason for selections: [4]

$M = -\frac{3}{2}$ looking for gradient $+\frac{2}{3}$

$3y = 2x + 5$ ✓

$2x - 3y = 8$ ✓

6.

A straight-line graph is to be drawn using the following information.

- It is perpendicular to the line with equation $2y = 4x + 3$.
- It intersects the line $x + 3y = 12$ at the point where $x = 0$.

Write down the equation of the straight-line that is to be drawn.
Then use the graph paper below to draw the graph of this straight line. [6]

From $2y = 4x + 3$

$y = \frac{4x}{2} + \frac{3}{2}$

$y = 2x + \frac{3}{2}$

gradient of our line $= -\frac{1}{2}$

$x + 3y = 12$ when $x = 0$ $\quad 3y = 12$

$y = 4$

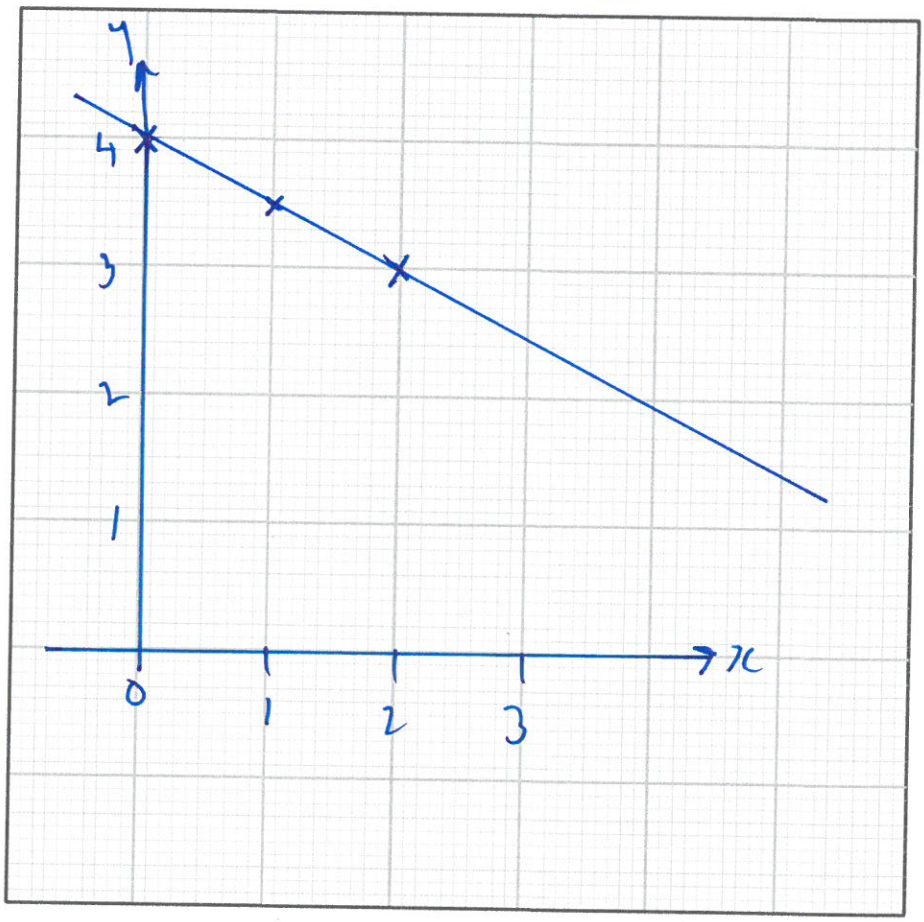
Intercept of our line $= +4$

B2

B1

B1

Equation of the straight-line: $y = -\frac{1}{2}x + 4$



B1

B1

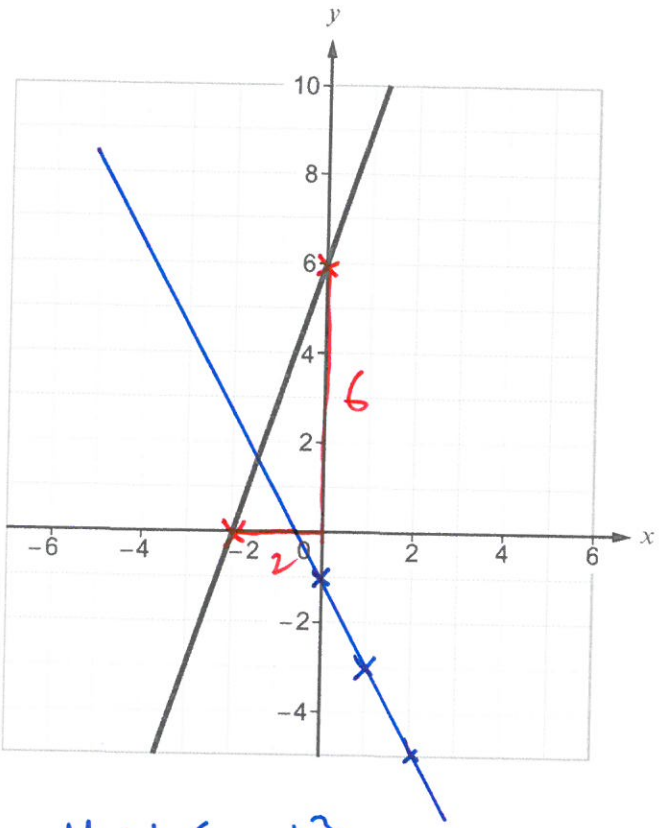
when $x = 1$ $\quad y = -\frac{1}{2} + 4 = +3.5$ $\quad (0, 4)$

$(1, 3.5)$

$x = 2$ $\quad y = -\frac{1}{2}x^2 + 4 = 3$ $\quad (2, 3)$

7.

(a) Find the equation of the straight line shown in the following diagram.
Write your answer in the form $y = mx + c$. [2]



$C = 6$ $\quad M = +\frac{6}{2} = +3$ B1

Equation of the straight line is $y =$ 3 $x +$ 6 B1

(b) On the grid above, draw the straight line which has a gradient of –2 and which passes through the point (0, –1). [2]

$y = -2x - 1$

$x = 1 \quad y = -2 - 1 = -3 \quad (1, -3)$

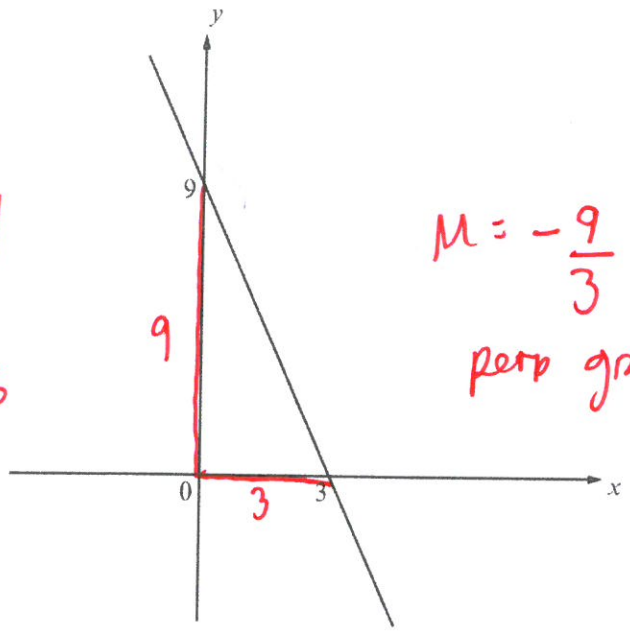
$x = 2 \quad y = -4 - 1 = -5 \quad (2, -5)$ B2

8.

$y = -3x + 9$

when $x = 1$

$y = -3 + 9 = 6$



$M = -\frac{9}{3} = -3$

perp gradient $+\frac{1}{3}$

The straight line, shown in the sketch above, intersects with another straight line which is not shown.
The other straight line is perpendicular to the straight line shown.
The two straight lines intersect at the point where $x = 1$.
Find the equation of this other straight line.

$y = mx + c$

$y = \frac{1}{3}x + c$

Lines cross @ (1, 6)

$6 = \frac{1}{3} \times 1 + c$

$6 = \frac{1}{3} + c$

$5\frac{2}{3} = c$

$c = \frac{17}{3}$ So $y = \frac{1}{3}x + \frac{17}{3}$

or $3y = x + 17$

[8]

Marking Scheme

1.

2.

7.(a)(i) Any two points calculated or plotted correctly, with no incorrect points, OR a correct straight line but may have an extra incorrect point plotted Points joined by one straight line	M2 A1	Otherwise M1 for any single correct point, not simply an intersection with an incorrect line, or from an incorrect calculation ((0,6) (1,4.5) (2,3) (3,1.5) (4, 0)) Single straight line, do not ignore incorrect points joined *If 1 error in manipulating the equation then penalise -1, then FT. More than 1 manipulative error gets no marks.*
7.(a)(ii) -1.5 or equivalent	B1	
7.(b) B D E in this order (y =5x y - 3x = 4 x + y – 5 = 0)	B3	B1 for each correct answer

3.

15. Selecting $4y = x$ AND $y = -4x$ Showing that $m_1 = ¼$ and $m_2 = -4$ $¼ \times -4 = -1$ or equivalent	B1 M1 A1 3	

4.

10.(a) A and D selected Gradients are both 3 or gradients are the same (b) A and E selected	B1 E1 B1 3	Depends on B1 being awarded. Accept 'slope' or similar. $m = 3$ or 'both 3x' is insufficient, needs interpretation

5.

15. Sight (gradient) -12/8 or 8/12 or equivalents Selects $3y = 2x + 5$ AND $2x - 3y = 8$ **only** Reason, e.g. 'gradient given times gradient of these lines is -1', or '(perpendicular) gradient is ⅔', or 'm×-1/m = -1', or 'product of gradients is -1'	B1 B2 E1 4	 Provided 1st B1 is awarded, allow further B1 for either selected with no more than 1 incorrect selection. *Sight of gradient 12/8 with perpendicular gradient -8/12 award B0, B2 for y =(-2x+8)/3 AND 2x + 3y = 8, or B0 B1 for either selected with no more than one incorrect selection.* FT their gradient

6.

Methods in Mathematics June 2015 Unit 1 Higher Tier	**Mark**	**Comment**
20. (Perpendicular gradient)–½ (Intersection with y axis, $x = 0$ gives) $y = 4$ (Equation) $y = - ½ x + 4$ or equivalent Uniform scales with y-intercept of graph at $y = 4$ Graph of $y = - ½ x + 4$	B2 B1 B1 B1 B1 6	B1 for sight of original gradient 2 or for sight of $y = 2x + 1.5$ or for line drawn with gradient – ½ from a line with gradient 2 May be indicated on the graph Award B4 for sight of $y = - ½ x + 4$ or equivalent FT for their y-intercept FT their linear equation with negative gradient and provided not $y = 2x + 1.5$

7.

7(a) $y = 3x + 6$	B2	B1 for $y = {}^{6}/_{2}\ x + 6$ or equivalent, or for $m = 3$ (must be clear that this is the gradient), or for $c = 6$ (must be clear that this is the intercept)
7(b) Correct straight line drawn (gradient -2, passing through (0,-1))	B2	B1 for any straight line drawn with gradient -2, or a straight line passing through (0, -1) with either gradient 2 or with a negative gradient

8.

15. $m = -9/3\ (=-3)$	B1	
$c = 9$	B1	
Equation $y = -3x + 9$	B1	FT their m and c
Use of $x = 1$ OR alternative method to find y coord.	M1	FT
$y = 6$	A1	FT
Perpendicular gradient $-1/m\ (= 1/3)$	B1	FT from their m
Method to find perpendicular equation	M1	FT their $-1/m$ and y coordinate.
$x - 3y + 17 = 0$ or equivalent	A1	Accept unsimplified forms. Ignore further
	8	incorrect working once a correct equation is seen