Year 12 Induction Tasks

Subject: A Level Mathematics

Welcome to A Level Maths!

Many students say that they find the initial transition from GCSE challenging, so in this booklet we have tried to focus on key skills that will be used across the whole spectrum of AS and A level Mathematics. Hence, we have come up with some engaging activities that will help you to recap and extend your knowledge.

Objectives:

- to gain an understanding of key skills that you need to have in order for you to have a smooth transition from GCSE to Year12.

Please complete the following tasks for the first Maths lesson of the academic year.

Task 1:

Year 12 Entry Assessment *(30 minutes & non Calculator)*

Topics to be revised: Indices & Roots, Surds, Factorise expressions (including quadratics), Simplify expressions & algebraic fractions, Substitution, Solve equations, Formulae, Sketch quadratics & Surface area of a cylinder.

Task 2:

What's the difference? This activity will help you recall the importance of order of operations.

Task 3:

Algebra Matching Activity & Indices matching Activity.

Task 4:

Problem Solving Questions:

Problem Solving 1: Quadratic Function Graph (revise how to use the solutions & the y-intercept)

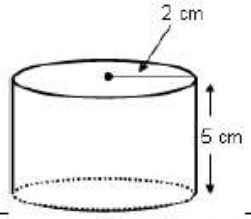
Problem Solving 2: Javelin B (revise the equation of a straight line & parallel straight lines).

Task 1

Year 12 Entry Assessment

30 minutes, non-calculator

Question	Workings (where necessary) and answer	Marks
1. Evaluate $\sqrt[3]{125}$		1
2. Evaluate 3^4		1
3. Evaluate $64^{\frac{2}{3}}$		1
4. Evaluate 11^{-2}		1
5. Evaluate $\left(1\frac{5}{8}\right)^{-2}$		1
6. Simplify $\frac{2x^2y \times (x^2z)^3}{8xy^3z}$		1
7. Factorise $x^2 - 11x + 18$		1
8. Factorise $4x^2 - 25$		1
9. Find the value of $y = 2x^3 + 3x^2 - 4x + 3$ when $x = -2$		1
10. Find the value of $y = 2x^3 + 3x^2 - 4x + 3$ when $x = \frac{1}{2}$		1
11. Solve $\frac{6x+3}{2} + 2x = 3x - 5(x-1)$		2
12. Simplify $\frac{2x + 18}{x^2 - 81}$		1

13. Make x the subject of the formula $$y = \frac{xw}{t} + p$$		1
14. Write as $a + b\sqrt{3}$ where a and b are integers $$(\sqrt{3})^2 - 2\sqrt{3} + \sqrt{75}$$		2
15. Simplify fully $$(\sqrt{5} + 4)(\sqrt{5} - 3\sqrt{10})$$		2
16. Rationalise the denominator and simplify $$\frac{2(\sqrt{2} + 6)}{\sqrt{2}}$$		2
17. Calculate $$\frac{3}{5} - \left(\frac{1}{2} + \frac{1}{3}\right) - 2$$		1
18. Find the *total* surface area of the cylinder below in terms of π.  		1
19. A curve C has the equation $$y = x^2 + 4x - 5$$ Sketch the graph of C, labelling the coordinates of the crossing points of the x and y axis.		2
20. Calculate 238×6.3		1
	Total	out of 25

Task 2

What's the Difference?

What's the Difference?

$2x^2 = 18$	$(2x)^2 = 18$	$2x^2 + 1 = 18$	$(2x + 1)^2 = 18$	$2(x + 1)^2 = 18$

This activity reminds students of the importance of following the order of operations.

Algebra matching Activity

Match up each expression from the first column with its partner from the second column, and write the answers in the table below.

First column				Second column			
1	$3x+4(x-3)$	11	$2a(1+c)-c(a+b)$	A	$2-x$	K	$2b(c-a)$
2	$2(3x\times 5y)$	12	$\frac{20x^2y^3}{5xy^2}$	B	$8x^3$	L	$ab-2ac+bc$
3	$a(b-c)-c(a-b)$	13	$xy+3x-x^2$	C	$2a+b$	M	$4x^2$
4	$4-2(3x+5)$	14	$6xy-2y^2+4y$	D	$12xy$	N	$3x+5$
5	$-(x-2)$	15	$2(3+x)-(1-x)$	E	$3x+1$	O	$2x^3y^3$
6	$(2x)^2$	16	$2a(c-b)-2c(a-b)$	F	$2y(3x-y+2)$	P	$7x-12$
7	$\frac{10a+5b}{5}$	17	$12\times 4x\times\frac{1}{4}y$	G	$4xy$	Q	$3a+2b-4c$
8	$25x^2y\div 5x$	18	$x^2\times y^2\times 2xy$	H	$30xy$	R	$x(y+3-x)$
9	$2x^2\times 4x$	19	$a+b-c+2a-3c+b$	I	$2x(1+y)$	S	$2a+ac-bc$
10	$(x+3)-2(1-x)$	20	$3(x+xy)-x(1+y)$	J	$-6-6x$	T	$5xy$

Table for Answers:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Indices Matching Activity

Match up each expression from the first column with its partner from the second column, and write the answers in the table below.

First column				Second column			
1	$\sqrt{x}$	11	$\frac{1}{x^2}\times\frac{1}{x^3}$	A	$x^{\frac{-3}{2}}$	K	$x^{\frac{-1}{2}}$
2	$\frac{1}{x}$	12	$\left(\sqrt[3]{x}\right)^2$	B	$\frac{1}{2}x^{-3}$	L	$x^{\frac{9}{2}}$
3	$\frac{1}{\sqrt{x}}$	13	$\sqrt{x^7}$	C	$\frac{1}{2}x^{-1}$	M	x^{-2}
4	$\sqrt[3]{x}$	14	$\sqrt{\left(\frac{1}{x^8}\right)}$	D	x^{-4}	N	$x^{\frac{3}{2}}$
5	$\frac{1}{x^2}$	15	$\frac{1}{\sqrt{x^{-8}}}$	E	x^{-1}	O	$2x^{-1}$
6	$\frac{1}{2x^3}$	16	$x\times\sqrt{x\times x^6}$	F	$\frac{1}{2}x$	P	$x^{\frac{1}{2}}$
7	$\frac{2}{x^3}$	17	$\sqrt{\left(\frac{4}{x^2}\right)}$	G	x^4	Q	x^{-5}
8	$x\sqrt{x}$	18	$\sqrt{\left(\frac{1}{4x^2}\right)}$	H	x^2	R	$x^{\frac{2}{3}}$
9	$\frac{\sqrt{x}}{x^2}$	19	$\sqrt{\left(\frac{x^2}{4}\right)}$	I	$2x$	S	$2x^{-3}$
10	$\frac{1}{x^{-2}}$	20	$\sqrt{4x^2}$	J	$x^{\frac{1}{3}}$	T	$x^{\frac{7}{2}}$

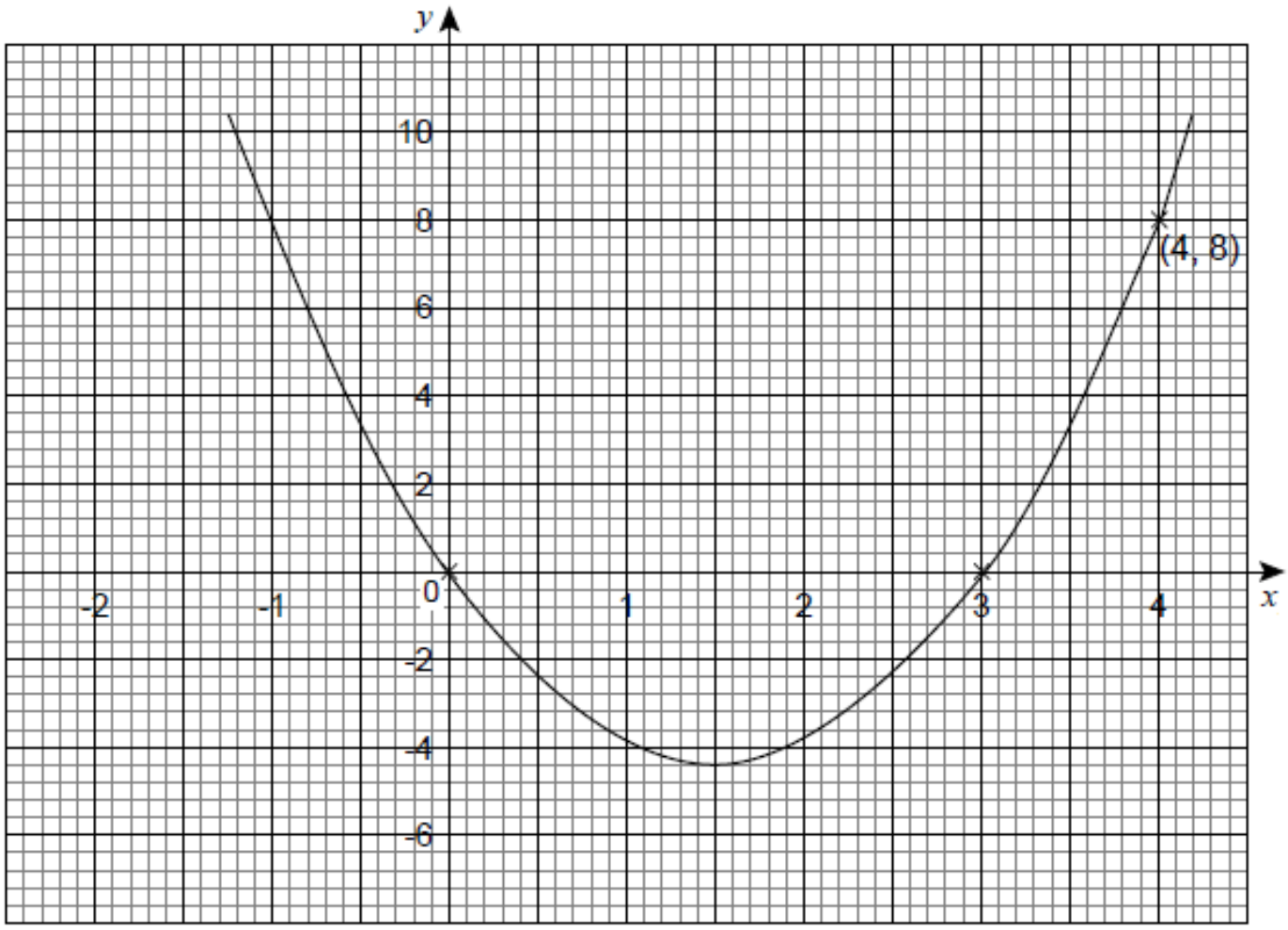
Table for Answers:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Problem Solving 1

Quadratic Function Graph

Here is part of the graph for a quadratic function.



Find the equation of the graph.

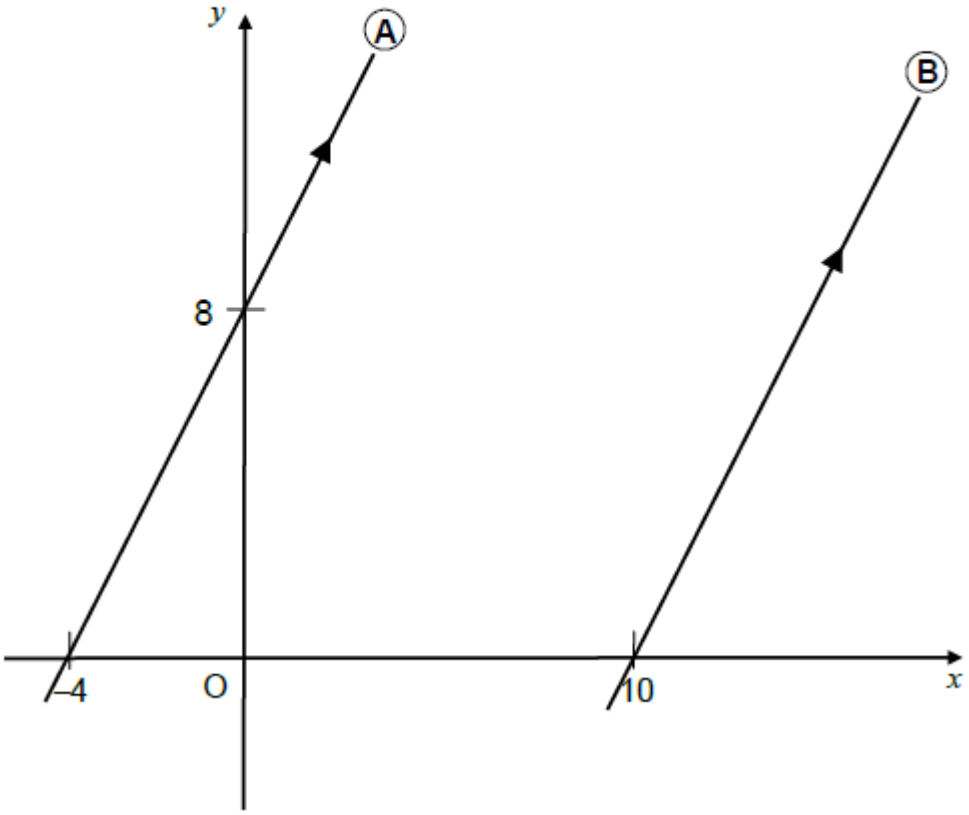
$y =$ .....

Problem Solving 2

Javelin B

The lines A and B are parallel

Not drawn accurately



What is the equation of line B?

Solutions

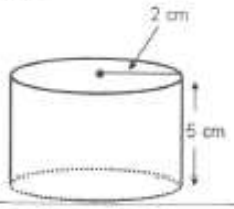
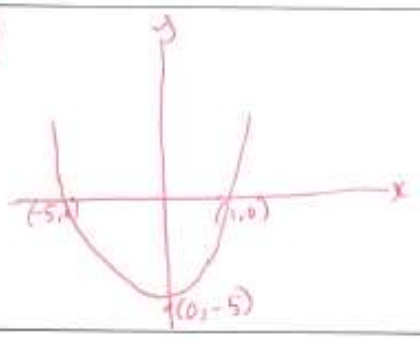
Task 1

Name: Answers

Year 12 Entry Assessment

30 minutes, non-calculator

Question	Workings (where necessary) and answer	Marks
1. Evaluate $\sqrt[3]{125}$	5	1
2. Evaluate 3^4	81	1
3. Evaluate $64^{\frac{2}{3}}$	16	1
4. Evaluate 11^{-2}	$\frac{1}{121}$	1
5. Evaluate $\left(1\frac{5}{8}\right)^{-2}$	$\frac{64}{169}$	1
6. Simplify $\frac{2x^2y \times (x^2z)^3}{8xy^3z}$	$\frac{x^7z^2}{4y^2}$	1
7. Factorise $x^2 - 11x + 18$	$(x-9)(x-2)$	1
8. Factorise $4x^2 - 25$	$(2x+5)(2x-5)$	1
9. Find the value of $y = 2x^3 + 3x^2 - 4x + 3$ when $x = -2$	7	1
10. Find the value of $y = 2x^3 + 3x^2 - 4x + 3$ when $x = \frac{1}{2}$	2	1
11. Solve $\frac{6x+3}{2} + 2x = 3x - 5(x-1)$	$6x+3+4x = 6x - 10(x-1)$ $10x+3 = 6x - 10x + 10$ $14x = 7$ $x = 7/14 = 1/2$	AWARD ONE MARK IF ONLY ONE ALGEBRAIC ERROR 2
12. Simplify $\frac{2x+18}{x^2-81}$	$\frac{2}{x-9}$	1

13. Make x the subject of the formula $y = \frac{xw}{t} + p$	$x = \frac{ty - pt}{w}$ or $x = \frac{ty}{w} - \frac{pt}{w}$ or $x = \frac{t(y-p)}{w}$ OE	1
14. Write as $a + b\sqrt{3}$ where a and b are integers $(\sqrt{3})^2 - 2\sqrt{3} + \sqrt{75}$	$3 - 2\sqrt{3} + \sqrt{25}\sqrt{3}$ $= 3 - 2\sqrt{3} + 5\sqrt{3}$ $= 3 + 3\sqrt{3}$	2
15. Simplify fully $(\sqrt{5}+4)(\sqrt{5}-3\sqrt{10})$	$5 + 4\sqrt{5} - 15\sqrt{2} - 12\sqrt{10}$	2
16. Rationalise the denominator and simplify $\frac{2(\sqrt{2}+6)}{\sqrt{2}}$	$2 + 6\sqrt{2}$	2
17. Calculate $\frac{3}{5} - \left(\frac{1}{2} + \frac{1}{3}\right) - 2$	$-\frac{67}{30}$ or $-2\frac{7}{30}$	1
18. Find the *total* surface area of the cylinder below in terms of π.  	Curved SA: 20π Base and top: 8π Total = 28π	1
19. A curve C has the equation $y = x^2 + 4x - 5$ Sketch the graph of C, labelling the coordinates of the crossing points of the x and y axis.	$(x+5)(x-1)$  	2
20. Calculate 238×6.3	1499.4	1
	Total	out of 25

Task 2

What's the Difference?

$2x^2 = 18$	$(2x)^2 = 18$	$2x^2 + 1 = 18$	$(2x+1)^2 = 18$	$2(x+1)^2 = 18$

$2x^2 = 18$

$x^2 = 9$

$x = \pm\sqrt{9}$

$x = \pm 3$

$(2x)^2 = 18$

$4x^2 = 18$

$x^2 = 4.5$

$x = \pm\sqrt{4.5}$

$2x^2 + 1 = 18$

$2x^2 = 17$

$x^2 = 8.5$

$x = \pm\sqrt{8.5}$

$(2x+1)^2 = 18$

$2x+1 = \pm\sqrt{18}$

$2x = \pm\sqrt{18} - 1$

$x = \dfrac{\pm\sqrt{18} - 1}{2}$

$\sqrt{18} = 3\sqrt{2}$

$x = \dfrac{\pm 3\sqrt{2} - 1}{2}$

$2(x+1)^2 = 18$

$(x+1)^2 = 9$

$x+1 = \pm\sqrt{9}$

$x = \pm 3 - 1$

$x = -4$ or $x = 2$

Task 3

Algebra matching Activity

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P	H	L	J	A	M	C	T	B	E	S	G	R	F	N	K	D	O	Q	I

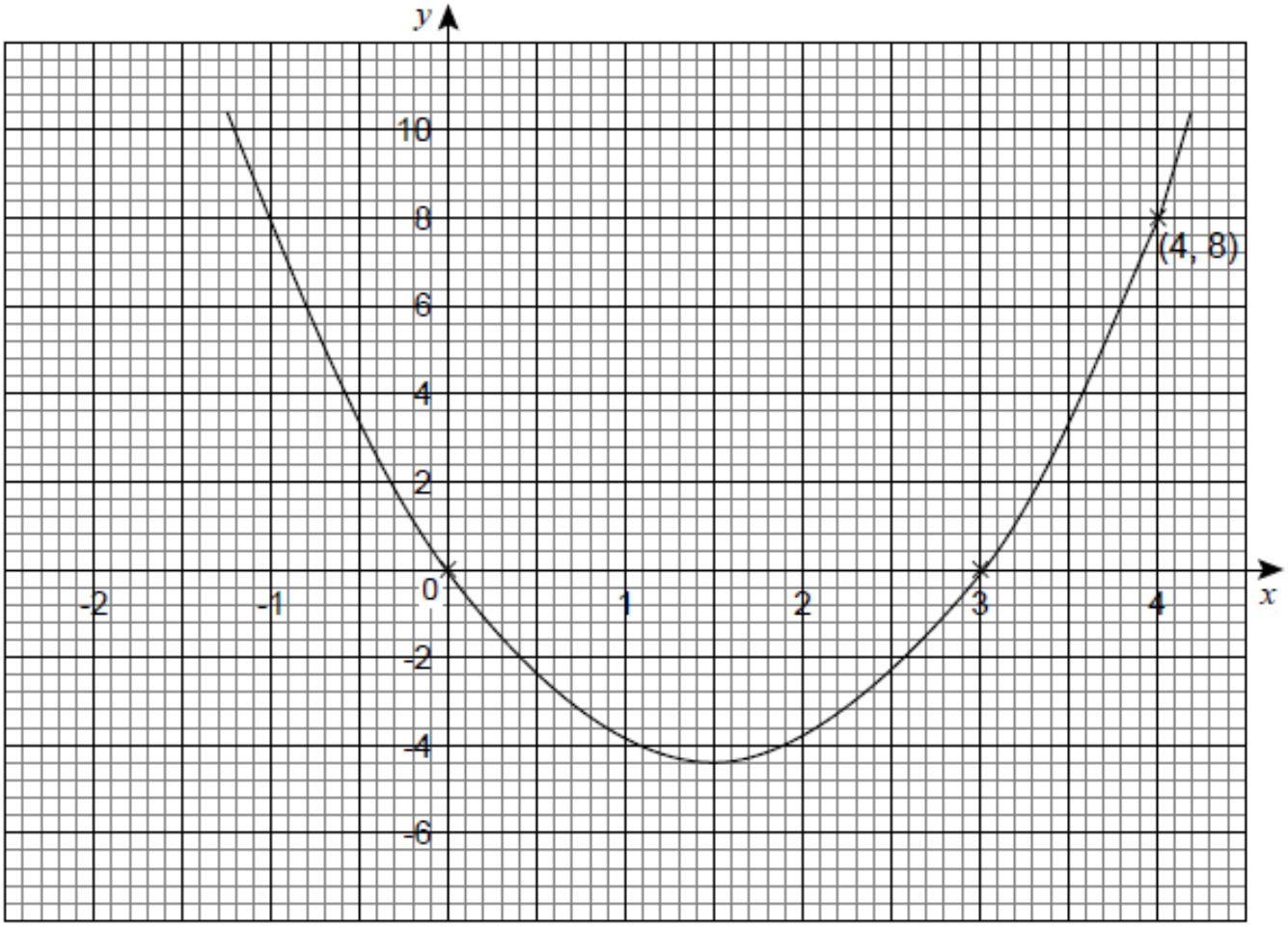
Indices Matching Activity

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P	E	K	J	M	B	S	N	A	H	Q	R	T	D	G	L	O	C	F	I

Task 4

Quadratic Function Graph

Here is part of the graph for a quadratic function.



Answer: $y = 2x(x-3) = 2x^2 - 6x$

$y = ax^2 + bx + c$ though $c = 0$

$y = ax^2 + bx$

co-ordinates $(4,8)$ $\rightarrow$ $8 = a \times 4^2 + b \times 4 \Rightarrow 8 = 16a + 4b \Rightarrow$

$2 = 4a + b \Rightarrow \boxed{b = 2 - 4a}$ (1)

Solutions $x = 0$ and $x = 3$ where $y = 0$

if $x = 3$ $\quad 0 = a \times 3^2 + b \times 3 \Rightarrow 9a + 3b = 0$ $\xrightarrow{(1)}$

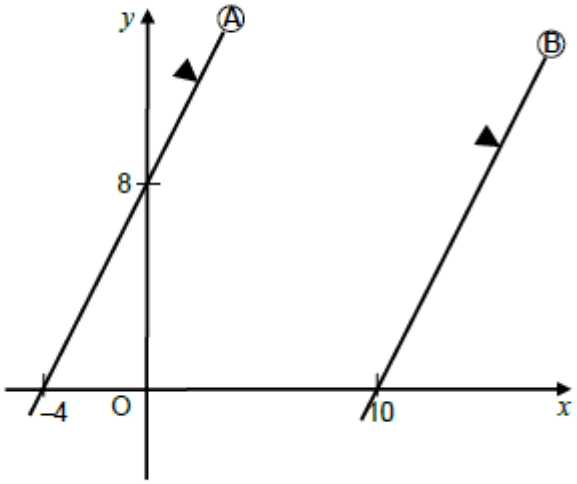
$9a + 3(2 - 4a) = 0 \Rightarrow 9a + 6 - 12a = 0 \Rightarrow \boxed{a = 2}$ (2)

$b = 2 - 4a \xrightarrow{(2)} b = 2 - 4 \times 2 \Rightarrow \boxed{b = -6}$

$\boxed{y = 2x^2 - 6x}$

Javelin B

The lines A and B are parallel



What is the equation of line B?

Answer	$y = 2x - 20$

Finding the answer

The two pieces of information that determine the equation of line B (slope and intercept) need to be found. The fact that parallel lines have the same slope needs to be understood so that the gradient of line B can be inferred from that of line A. Then the increase in y over increase in x formulation for gradient can be applied to the triangle containing the intercepts for line A. This gives 8/4 = 2 and so $m = 2$ for line B.

The intercept for line B can be found in (at least) two distinct ways:

1. Solving an equation for $y = 2x + c$ through the point (10, 0).
2. An alternative method, involving proportionate thinking based on the known gradient (2), would be to note that on line B at (10, 0) moving 10 units left must be equivalent to moving 20 units down so that the intercept of B must be at (0, –20).