

5-Aug-24

Objective: **Complete iGCSE questions on variation and proportion.**

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15	$\frac{6}{\sqrt{x}}$ oe	2	<b>M1</b> for $y = \frac{k}{\sqrt{x}}$ or <b>M1</b> for $k = 6$ with no correct equation
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- 3  $y$  is directly proportional to  $(x+1)^3$ .  
 $y = 32$  when  $x = 3$ .

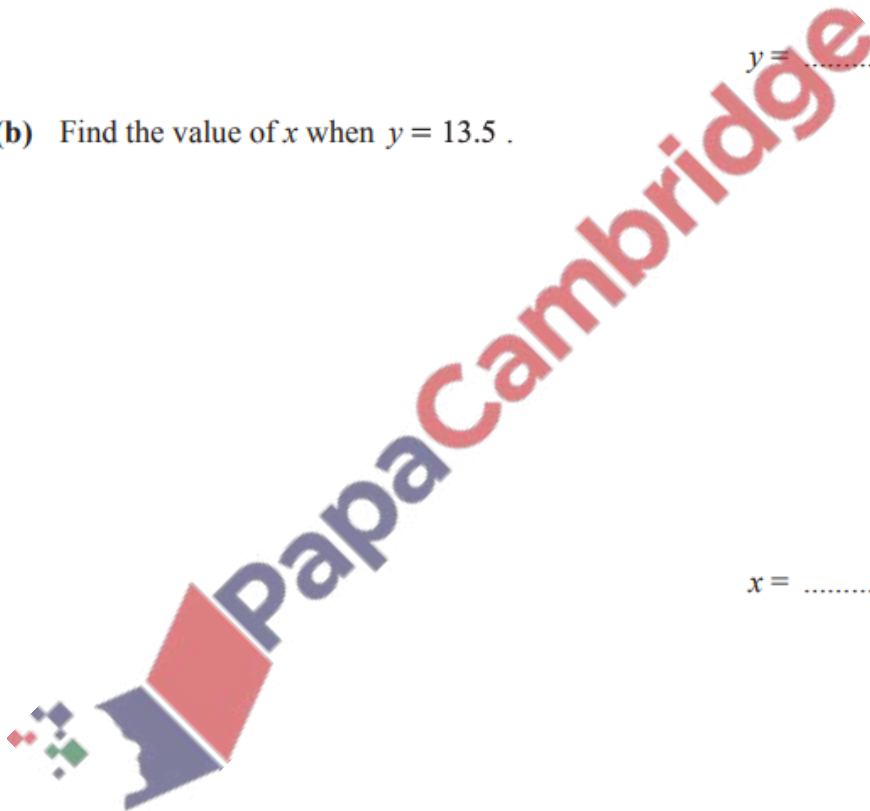
(a) Find the value of  $y$  when  $x = 4$ .

$y =$  .....

(b) Find the value of  $x$  when  $y = 13.5$ .

$x =$  .....

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(c) Find  $x$  in terms of  $y$ .

$$x = \dots\dots\dots$$

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3	(a)	62.5	3	<b>B1</b> for $y = k(x + 1)^3$ <b>B1</b> for $k = 0.5$  OR <b>M2</b> for $\frac{y}{32} = \frac{(4 + 1)^3}{(3 + 1)^3}$
	(b)	2	2	<b>B1FT</b> for $x + 1 = \sqrt[3]{\textit{their } 27}$
	(c)	$x = \sqrt[3]{2y} - 1$ oe final answer	3	<b>M1</b> for division by <i>their</i> $k$ <b>M1</b> for cube root <b>M1</b> for subtracting 1, must be final st

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- 2 The frequency of a radio wave,  $f$ , is inversely proportional to the wavelength,  $L$  metres.  
A radio station broadcasts on a frequency of 93.7 and a wavelength of 3.2 m.
- (a) Find a formula for  $f$ , in terms of  $L$ , writing any constants correct to 3 significant figures.

$f =$  .....

- (b) Chat Radio broadcasts with a wavelength of 2.8 m.

Find the frequency of Chat Radio.

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- (c) Allsports Radio broadcasts with a frequency of 0.35 .

Find the wavelength of Allsports Radio.



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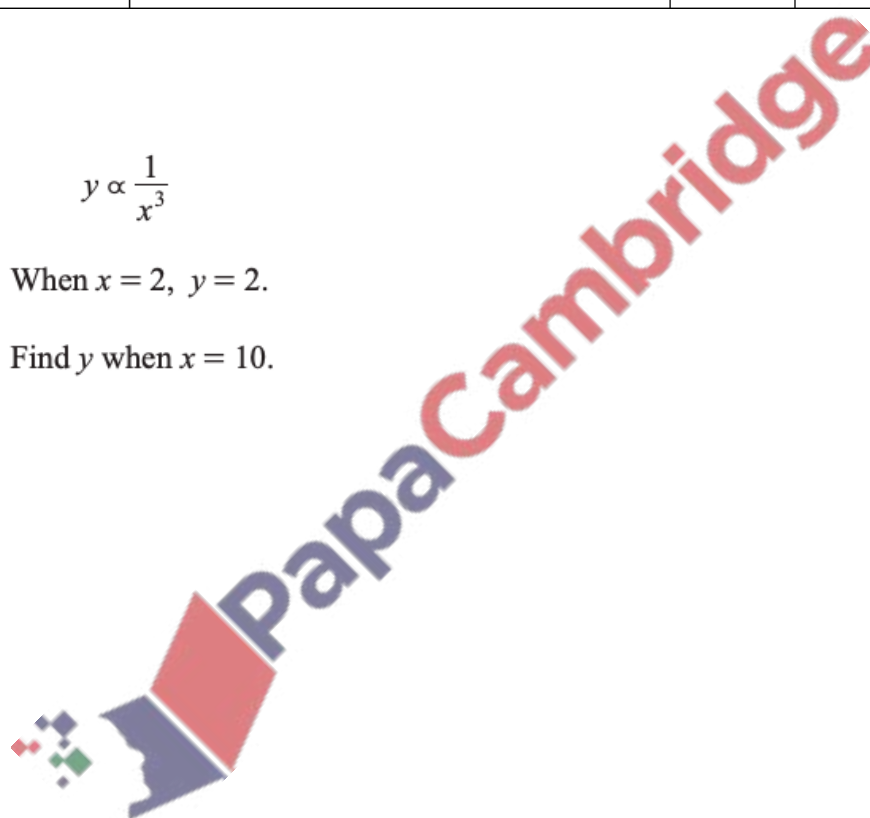
<b>2</b> <b>(a)</b>	$\frac{300}{L}$ oe	<b>3</b>	<b>M1</b> for $f = \frac{k}{L}$ soi oe <b>M1</b> (Dep on 1 <sup>st</sup> <b>M1</b> ) for substituting $f = 3.2$ soi by 299.8 or 299.84
<b>(b)</b>	107 or 107.0 to 107.1 ...	<b>1FT</b>	<b>FT</b> $\frac{\text{their } k}{L}$ oe only
<b>(c)</b>	857 or 856.5 to 857.1 ...	<b>2FT</b>	<b>FT</b> $\frac{\text{their } k}{L}$ oe only <b>M1</b> for $0.35 = \frac{\text{their } k}{L}$

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**15**       $y \propto \frac{1}{x^3}$

When  $x = 2$ ,  $y = 2$ .

Find  $y$  when  $x = 10$ .



$y = \dots\dots\dots$

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Question	Answer	Marks	Part Marks
15	$\frac{16}{1000}$ oe	3	<b>M1</b> for $y = \frac{k}{x^3}$ oe <b>M1</b> for substituting $x = 2$ and $y = 2$ in equation to find $k$

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- 6 (a) (i)  $x$  is proportional to  $v$ .

Write down an expression for  $x$  in terms of  $v$  and a constant  $c$ .

$x = \dots\dots\dots$

- (ii)  $y$  is proportional to  $v^2$ .

Write down an expression for  $y$  in terms of  $v$  and a constant  $k$ .

$y = \dots\dots\dots$

- (iii)  $d = x + y$

Write down an expression for  $d$  in terms of  $v$ ,  $c$  and  $k$ .

$d = \dots\dots\dots$



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- (b) The table shows two values of  $v$  and the corresponding values of  $d$ .

$v$	$d$
12	750
20	2050

Using your answer to **part (a)(iii)**,

- (i) show that  $125 = 2c + 24k$ ,

- (ii) write down a second equation connecting  $c$  and  $k$ .

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(c) Solve the simultaneous equations in **part (b)** to find the value of  $c$  and the value of  $k$ .

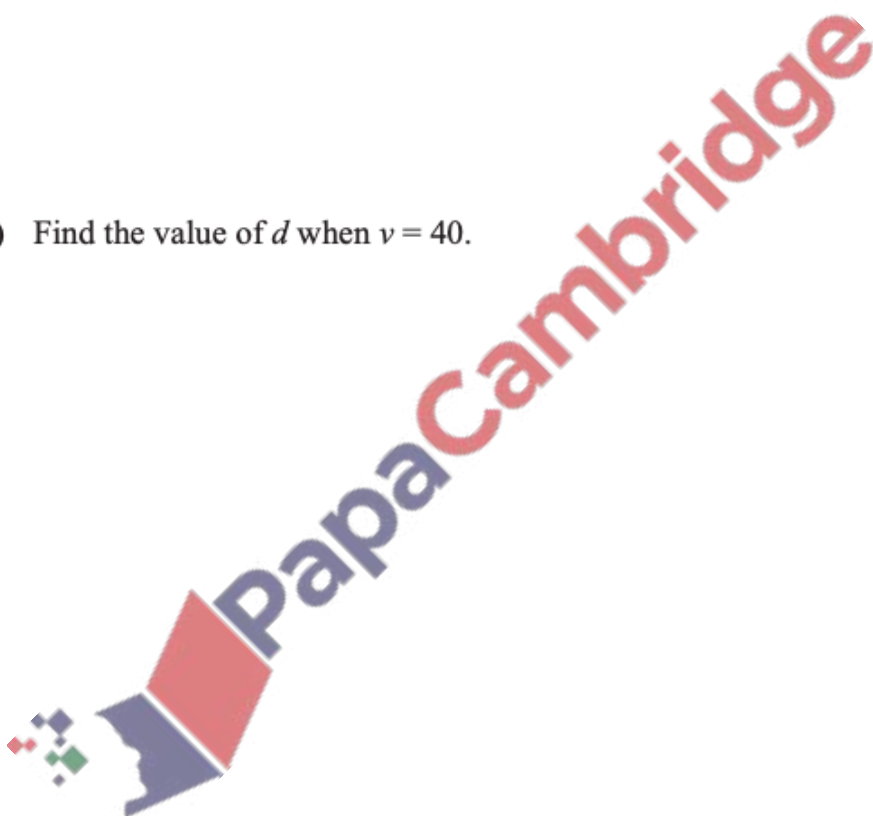
$c = \dots\dots\dots$

$k = \dots\dots\dots$

(d) Find the value of  $d$  when  $v = 40$ .

$d = \dots\dots\dots$

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6(a)(i)	$[x =] cv$ oe	<b>1</b>	
6(a)(ii)	$[y =] kv^2$ oe	<b>1</b>	
6(a)(iii)	$[d =] cv + kv^2$ or $v(c + kv)$ oe	<b>1</b>	<b>FT</b>
6(b)(i)	$750 = 12c + 12^2 k$ oe	<b>M1</b>	isw any cancelling
6(b)(ii)	$2050 = 20c + 20^2 k$ oe	<b>1</b>	isw any cancelling
6(c)	$[c =] 2.5$ oe cao $[k =] 5$ cao	<b>3</b>	<b>M1</b> for correctly eliminating one variable <i>their</i> equations in this part. or sketches of lines  <b>A1</b> for either solution If zero scored <b>SC1</b> for <i>their</i> values satisfy equation.
6(d)	8100	<b>2</b>	<b>M1</b> for correct substitution of 40 into <i>the</i> containing <i>their</i> values of $c$ and $k$ .

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- 6  $y$  varies inversely as the square of  $x$ .  
 $y = 32$  when  $x = 2$ .

(a) Find the value of  $y$  when  $x = 4$ .

$y = \dots\dots\dots$

(b) Find the value of  $x$  when  $y = 512$ .

$x = \dots\dots\dots$

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(c) Find  $x$  in terms of  $y$ .

$x = \dots\dots\dots$

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Question	Answer	Marks	Partial Marks
6(a)	8	3	<b>M1</b> for $y = \frac{k}{x^2}$ oe <b>A1</b> for $k = 128$  OR <b>M2</b> for $32 \div \left(\frac{4}{2}\right)^2$ oe or <b>M1</b> for $\frac{y}{32} = \frac{4^2}{\frac{1}{2^2}}$ oe
6(b)	$[\pm] \frac{1}{2}$ oe	2	<b>M1</b> for $x^2 = \frac{\text{their } k}{512}$ oe or $2 \times \sqrt{\frac{32}{512}}$ oe
6(c)	$[x = \pm] \sqrt{\frac{128}{y}}$ oe final answer	3	<b>M1</b> for multiplication by $x^2$ <b>M1</b> for division by $y$ or for square root

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- 8  $y$  varies inversely as  $x^2$ .  
When  $x = 3, y = 4$ .

Find  $y$  in terms of  $x$ .

$y =$  .....

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8	$\frac{36}{x^2}$	2	<b>M1</b> for $y = \frac{k}{x^2}$ oe or $yx^2 = k$
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- 3 (a)  $y$  varies directly as the square root of  $x$ .  
 $y = 32$  when  $x = 16$ .

(i) Find  $y$  in terms of  $x$ .

$y = \dots\dots\dots$

(ii) Find the value of  $y$  when  $x = 4$ .

$y = \dots\dots\dots$

(iii) Find  $x$  in terms of  $y$ .

$x = \dots\dots\dots$

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- (b)  $p$  varies inversely as  $q + 2$ .  
 $p = 3$  when  $q = 2$ .

Find the value of  $p$  when  $q = 4$ .

$p = \dots\dots\dots$

3(a)(i)	$8\sqrt{x}$ oe	2	<b>M1</b> for $y = k\sqrt{x}$
3(a)(ii)	16	1	
3(a)(iii)	$\frac{y^2}{64}$ or $\left(\frac{y}{8}\right)^2$ or $\frac{y^2}{8^2}$	2	<b>FT</b> only if wrong $k$ , $k$ numeric and $k \neq 1$ <b>M1</b> for $\frac{y}{\text{their } k} = \sqrt{x}$ or $y^2 = (\text{their } k\sqrt{x})^2$ better <b>SC1</b> for answer $\frac{y^2}{k^2}$ or $\left(\frac{y}{k}\right)^2$

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3(b)	2	3	<b>M2</b> for $p = \frac{12}{q+2}$ oe or $p = \frac{12}{4+2}$ oe or <b>M1</b> for $p = \frac{k}{q+2}$  OR  <b>M2</b> for $p = \frac{3(2+2)}{4+2}$ or <b>M1</b> for $p(4+2) = 3(2+2)$
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- 17  $y$  is inversely proportional to  $\sqrt{x+4}$ .  
When  $x = 5$ ,  $y = 12$ .

Find  $y$  in terms of  $x$ .

$y = \dots\dots\dots$

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17	$\frac{36}{\sqrt{x+4}}$	2	M1 for $12 = \frac{k}{\sqrt{5+4}}$
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- 12 (a)  $y$  varies directly as the square root of  $(x + 1)$ .  
 $y = 8$  when  $x = 24$ .

(i) Find the value of  $y$  when  $x = 15$ .

$y =$  .....

(ii) Find the value of  $x$  when  $y = 16$ .

$x =$  .....

12(a)(i)	6.4	3	<p><b>M2</b> for <math>y = 1.6\sqrt{x+1}</math>  or <b>M1</b> for <math>y = k\sqrt{x+1}</math></p> <p>OR</p> <p><b>M2</b> for <math>y = \frac{8\sqrt{16}}{\sqrt{25}}</math>  or <b>M1</b> for <math>\frac{8}{\sqrt{25}} = \frac{y}{\sqrt{16}}</math></p>
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12(a)(ii)	99	2	FT M1 for $\sqrt{x+1} = \frac{16}{their 1.6}$ oe only FT $\sqrt{x+1}$
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- 6  $y$  is inversely proportional to  $\sqrt{x}$ .  
When  $x = 9$ ,  $y = 6$ .

(a) (i) Find an equation connecting  $x$  and  $y$ .

(ii) Calculate  $y$  when  $x = 30$ .

(iii) Calculate  $x$  when  $y = 15$ .



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- (b) For the three variables  $x, y$  and  $z$ ,  $z$  is also proportional to  $(y + 5)$ .  
When  $x = 9$ ,  $z = 33$ .

Find an equation connecting  $x$  and  $z$ .

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6(a)(i)	$y = \frac{18}{\sqrt{x}}$ oe	2	M1 for $y = \frac{k}{\sqrt{x}}$ oe
6(a)(ii)	3.29 or 3.286...	1	FT wrong $k$ only
6(a)(iii)	1.44 oe	2	M1 for $\sqrt{x} = \frac{\text{their } 18}{15}$ or $225 = \frac{(\text{the}}{15}$
6(b)	$z = 3\left(\frac{18}{\sqrt{x}} + 5\right)$ oe	2	M1 for $z = K(\text{their}(a(i)) + 5)$ $K \neq 1$ or for $z = 3(y + 5)$

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- 14  $y$  varies inversely as the square root of  $x$ .  
When  $x = 25$ ,  $y = 6$ .

Find  $y$  in terms of  $x$ .

$y = \dots\dots\dots$

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14	$y = \frac{30}{\sqrt{x}}$	2	M1 for $y = \frac{k}{\sqrt{x}}$ oe
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- 11  $y$  is inversely proportional to  $\sqrt{x}$ .  
When  $x = 9$ ,  $y = 2$ .

Find  $y$  in terms of  $x$ .



$y = \dots\dots\dots$

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11	$\frac{6}{\sqrt{x}}$	2	<b>M1</b> for $2 = \frac{k}{\sqrt{9}}$
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8(a)(i)	$0.05 = \frac{k}{\sqrt{25}}$ oe	<b>M1</b>	
	$k = 0.25$ and $y = \frac{1}{4\sqrt{x}}$	<b>A1</b>	

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8(a)(ii)	$[\pm]\frac{1}{12}$ oe	1	
8(a)(iii)	$\frac{1}{16y^2}$ or $\frac{1}{(4y)^2}$ oe	2	<b>M1</b> for $4y\sqrt{x} = 1$ or better or for $y^2 = \frac{1}{16x}$
8(a)(iv)	$\frac{1}{4}$ oe cao	1	
8(b)	3	2	<b>B1</b> for $2^3$ soi

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- 16  $p$  varies inversely as the square root of  $q$ .  
When  $q = 9, p = 12$ .

Find  $p$  when  $q = 16$ .

$p = \dots\dots\dots$

Question	Answer	Marks	Partial Marks
16	9	3	<b>B2</b> for $p = \frac{36}{\sqrt{q}}$ oe or $\frac{12 \times \sqrt{9}}{\sqrt{16}} = p$ or better or <b>M1</b> for $p = \frac{k}{\sqrt{q}}$ oe or $12 \times \sqrt{9} = p \times \sqrt{16}$

- (iv) Find  $x$  when  $y = \frac{1}{2}$ .

$\dots\dots\dots$

- (b)  $b$  is inversely proportional to  $a^3$ .  
When  $a = P, b = 24$ .

Find  $b$  when  $a = 2P$ .

$\dots\dots\dots$

- 8 (a)  $y$  is inversely proportional to the square root of  $x$ .  
When  $x = 25$ ,  $y = 0.05$ .

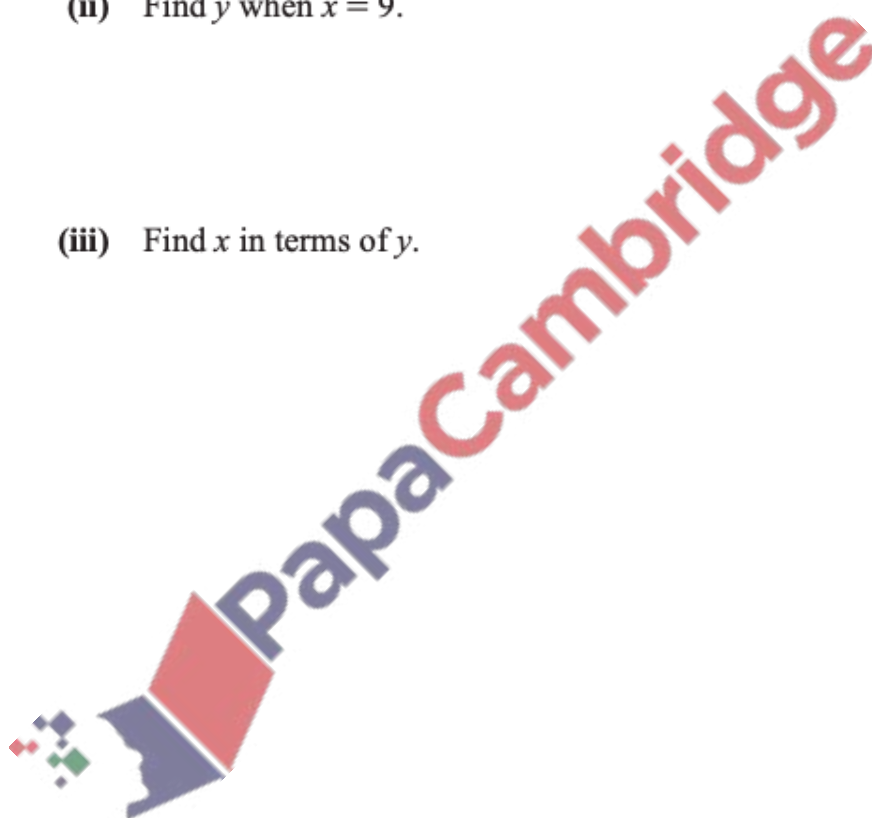
(i) Show that  $y = \frac{1}{4\sqrt{x}}$ .

- (ii) Find  $y$  when  $x = 9$ .

- (iii) Find  $x$  in terms of  $y$ .

.....

$x =$  .....



15  $y \propto \frac{1}{\sqrt{x}}$

When  $x = 4$ ,  $y = 3$ .

Find  $y$  in terms of  $x$ .

$y = \dots\dots\dots$

