

**Secondary Two Express Mathematics**

**End of Year Examination Paper 1**

<b>Marks</b>	<b>50</b>
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<b>1.</b>	<p>Expand and simplify each of the following:</p> <p>(a) <math>2(3p - 5)</math>,</p> <p>(b) <math>3(r + 6) - 2(r - 3)</math>.</p> <p style="text-align: right;">Answer: (a) .....[1] (b) .....[1]</p>	<i>For Examiner's Use</i>
<b>2.</b>	<p>A map has a scale of 1cm to 5km.</p> <p>(a) Write down the representative fraction of the map in the form of 1:n.</p> <p>(b) A road stretches for 7.5km on the actual ground. How long will the road be on the map?</p> <p>(c) What will be the actual area of a pond that is represented by <math>18\text{cm}^2</math> on the map?</p> <p style="text-align: right;">Answer: (a).....[1] (b).....[2] (c).....[2]</p>	

3. Factorize the following expressions completely.

(a)  $9x^2 - 25y^2$ ,

(b)  $pq + 4p + 3q + 12$ .

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Answer: (a) .....[1]

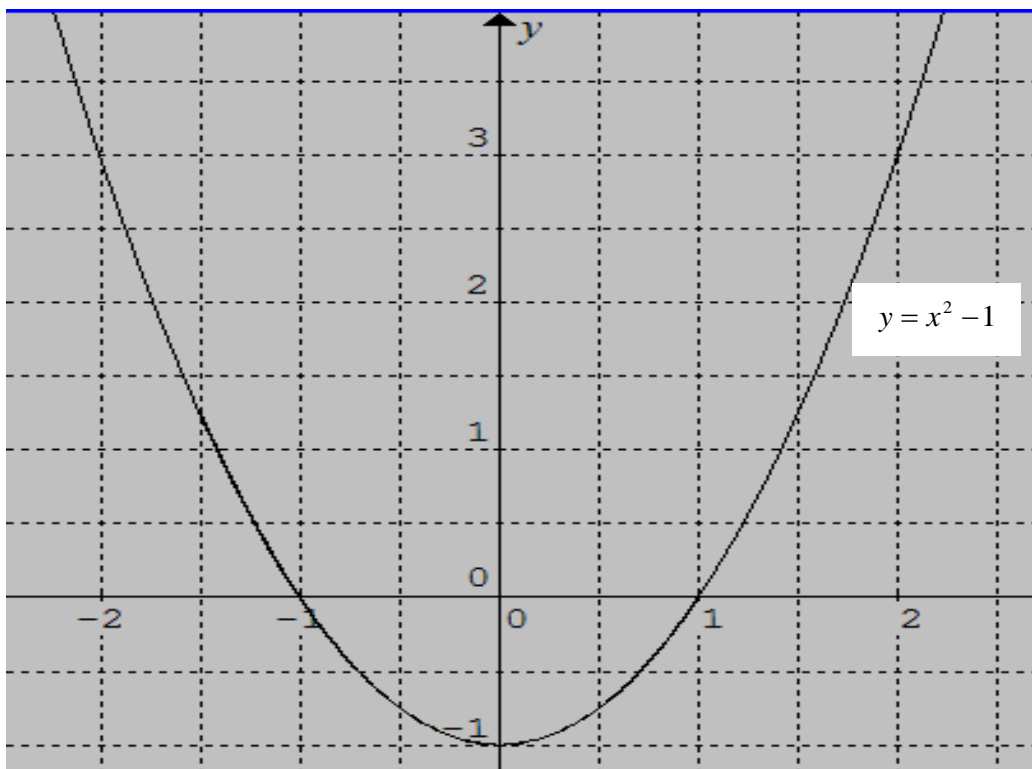
(b) .....[1]

4. The plot of  $y = x^2 - 1$  is as shown below.

(a) Find the values of  $x$  when  $y = 3$ .

(b) Write down the coordinates of the minimum point.

(c) State the equation of the line of symmetry.



Answer: (a).....[1]

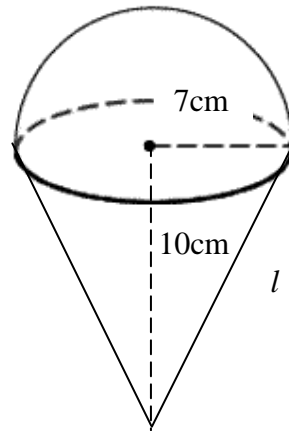
(b).....[1]

(c).....[1]

<p><b>5.</b></p>	<p>Expand and simplify each of the following:</p> <p>(a) <math>(3a + 2)(3a - 2)</math>  (b) <math>(3s - 1)(s^2 - 6s + 3)</math></p> <p style="text-align: right;">Answer: (a) .....[1]  (b) .....[2]</p>	<p><i>For Examiner's Use</i></p>
<p><b>6.</b></p>	<p>Express the following as a fraction in the simplest form:</p> <p>(a) <math>\frac{4}{2a-1} - \frac{1}{a+2}</math>                      (b) <math>\frac{xy^3}{2z^2} \div \frac{8y^5}{(xz)^3} \times \frac{4z}{16x}</math></p> <p style="text-align: right;">Answer: (a) .....[2]  (b) .....[2]</p>	

<p><b>7.</b></p>	<p>Given that <math>V = \frac{4}{3}\pi R^3 + \frac{1}{3}\pi r^2 h</math>,          Find the value of <math>V</math> when <math>R = 5</math>, <math>r = 2.5</math>, <math>h = 6</math> and <math>\pi = 3.142</math>.</p> <p style="text-align: right;">Answer: .....[2]</p>	<p><i>For Examiner's Use</i></p>
<p><b>8.</b></p>	<p>Solve the following equations:</p> <p>(a) <math>3x^2 + 5x + 2 = 0</math></p> <p>(b) <math>\frac{2}{x+4} + \frac{1}{x^2-16} = 0</math></p> <p style="text-align: right;">Answer: (a) <math>x = \dots\dots\dots</math> or <math>\dots\dots\dots</math>[3]          (b) <math>x = \dots\dots\dots</math>[3]</p>	

9. An object is formed by combining a hemisphere with a cone. Given that the radius and the height of the cone is 7cm and 10cm respectively, calculate the
- (a) value of  $l$ ,
  - (b) total surface area of the object,
  - (c) volume of the object.

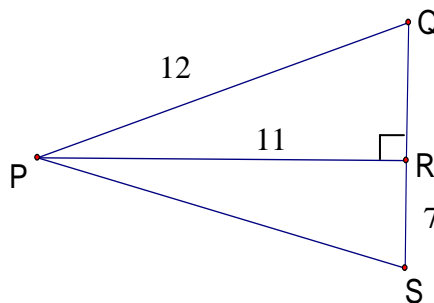


Answer: (a).....[2]  
(b).....[3]  
(c).....[3]

10.  $PQRS$  is formed by 2 right angled triangles.  $\angle PRQ = \angle PRS = 90^\circ$ .  $PQ = 12\text{cm}$ ,  $PR = 11\text{cm}$  and  $RS = 7\text{cm}$ .

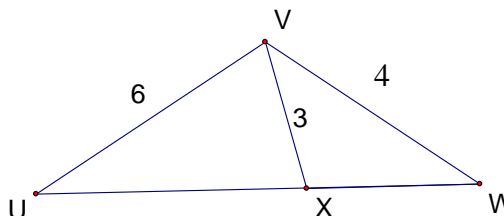
- (a) Show that (i)  $QR^2 = 23\text{cm}^2$ ,  
(ii)  $PS^2 = 170\text{cm}^2$ .

(b) Hence, find the area of  $\Delta PQS$ .



Answer: (a)(i).....(show above).....[1]  
(ii).....(show above).....[1]  
(b).....[1]

11. Triangles  $UVW$  and  $VXW$  are similar.  
 $UV = 6\text{cm}$ ,  $VX = 3\text{cm}$  and  $VW = 4\text{cm}$ .  
Find the length of  $WX$ .



Answer: .....[2]

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12.  $A$  is directly proportional to  $r^2$ . Given that  $A = 3$ ,  $r = 4$ ,

(a) form an equation relating  $A$  and  $r$ ,

(b) find the value of  $A$  when  $r = 6$ ,

(c) find the values of  $r$  when  $A = 5$ .

Answer: (a).....[2]

(b).....[2]

(c).....[2]

13. The mass of 30 fishes were measured.

(a) Complete the following table. [3]

Mass (g)	Mid value (x)	Frequency (f)	$fx$
$100 < x \leq 200$		8	
$200 < x \leq 300$			2500
$300 < x \leq 400$		12	
		$\Sigma f =$	$\Sigma fx =$

(b) Find the mean mass of the fishes.

Answer: .....[1]

**End of Paper**

## Solutions

<b>1.</b>	<p>Expand and simplify each of the following:</p> <p>(a) <math>2(3p - 5)</math>,</p> <p>(b) <math>3(r + 6) - 2(r - 3)</math>.</p> <p>(b) <math>3r + 18 - 2r + 6</math>  <math>= r + 24</math></p>	<p style="font-size: small;"><i>For Examiner's Use</i></p>	
	<p>Answer: (a) <math>6p - 10</math> [1]</p> <p>(c) <math>r + 24</math> [1]</p>	<p>[B1]</p> <p>[B1]</p>	
<b>2.</b>	<p>A map has a scale of 1cm to 5km.</p> <p>(a) Write down the representative fraction of the map in the form of 1:n.</p> <p>(b) A road stretches for 7.5km on the actual ground. How long will the road be on the map?</p> <p>(c) What will be the actual area of a pond that is represented by <math>18\text{cm}^2</math> on the map?</p> <p>(a) <math>5\text{km} = 5000\text{m} = 500,000\text{cm}</math>            RF = 1: 500,000</p> <p>(b) <math>5\text{km} \rightarrow 1\text{cm}</math>  <math>1\text{km} \rightarrow 0.2\text{cm}</math>  <math>7.5\text{km} \rightarrow 7.5 * 0.2 = 1.5\text{cm}</math> [M1]</p> <p>(c) <math>1\text{cm} \rightarrow 5\text{km}</math>  <math>1\text{cm}^2 \rightarrow 25\text{km}^2</math>  <math>18\text{cm}^2 \rightarrow 18 * 25 = 450\text{km}^2</math> [M1]</p>	<p>Answer: (a) 1: 500,000 [1]</p> <p>(b) 1.5cm [2]</p> <p>(c) <math>450\text{cm}^2</math> [2]</p>	<p>[B1]</p> <p>[A1]</p>



3. Factorize the following expressions completely.

(a)  $9x^2 - 25y^2$ ,

(b)  $pq + 4p + 3q + 12$ .

(b)  $pq + 4p + 3q + 12$

$= p(q + 4) + 3(q + 4)$

$= (p + 3)(q + 4)$

Answer: (a)  $(3x + 5y)(3x - 5y)$  [1]

(c)  $(p + 3)(q + 4)$  [1]

[A1]

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[B1]

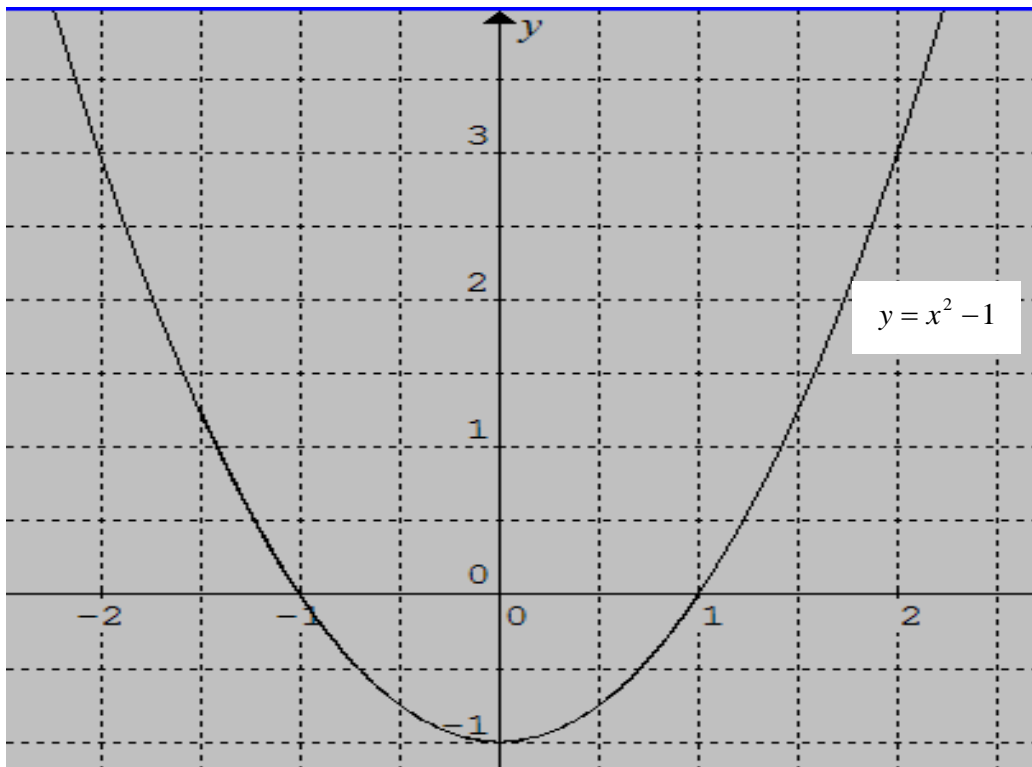
[B1]

4. The plot of  $y = x^2 - 1$  is as shown below.

(a) Find the values of  $x$  when  $y = 3$ .

(b) Write down the coordinates of the minimum point.

(c) State the equation of the line of symmetry.



Answer: (a)  $x = -2$  or  $2$  [1]

(b)  $(0, -1)$  [1]

(c)  $x = -1$  [1]

[G1]

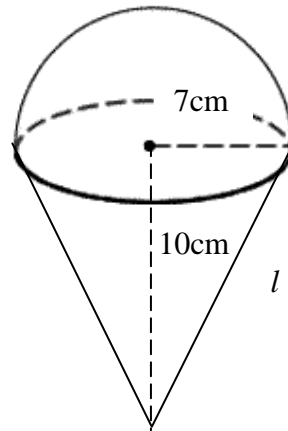
[B1]

[B1]

<p><b>5.</b></p>	<p>Expand and simplify each of the following:</p> <p>(c) <math>(3a + 2)(3a - 2)</math>  (b) <math>(3s - 1)(s^2 - 6s + 3)</math></p> <p>(b) <math>(3s - 1)(s^2 - 6s + 3)</math>  <math>= 3s^3 - 18s^2 + 9s - s^2 + 6s - 3</math> [M1]  <math>= 3s^3 - 19s^2 + 15s - 3</math></p> <p style="text-align: right;">Answer: (a) <math>9a^2 - 4</math> [1]  (c) <math>3s^3 - 19s^2 + 15s - 3</math> [2]</p>	<p><i>For Examiner's Use</i></p> <p>[B1] [A1]</p>
<p><b>6.</b></p>	<p>Express the following as a fraction in the simplest form:</p> <p>(a) <math>\frac{4}{2a-1} - \frac{1}{a+2}</math>                      (b) <math>\frac{xy^3}{2z^2} \div \frac{8y^5}{(xz)^3} \times \frac{4z}{16x}</math></p> <p>(a) <math>\frac{4}{2a-1} - \frac{1}{a+2}</math>                      (b) <math>\frac{xy^3}{2z^2} \div \frac{8y^5}{(xz)^3} \times \frac{4z}{16x}</math></p> <p><math>= \frac{4(a+2) - (2a-1)}{(2a-1)(a+2)}</math> [M1]                      <math>= \frac{xy^3}{2z^2} \times \frac{x^3z^3}{8y^5} \times \frac{4z}{16x}</math> [M1]</p> <p><math>= \frac{4a+8-2a+1}{(2a-1)(a+2)}</math>                      <math>= \frac{x^3z^2}{64y^2}</math></p> <p><math>= \frac{2a+9}{(2a-1)(a+2)}</math></p> <p style="text-align: right;">Answer: (a) <math>\frac{2a+9}{(2a-1)(a+2)}</math> [2]                      (d) <math>\frac{x^3z^2}{64y^2}</math> [2]</p>	<p>[A1] [A1]</p>

<p>7.</p>	<p>Given that <math>V = \frac{4}{3}\pi R^3 + \frac{1}{3}\pi r^2 h</math>,  Find the value of <math>V</math> when <math>R = 5</math>, <math>r = 2.5</math>, <math>h = 6</math> and <math>\pi = 3.142</math>.</p> $V = \frac{4}{3}(3.142)(5)^3 + \frac{1}{3}(3.142)(2.5)^2(6) \quad [M1]$ $= 562.942$ $= 563$ <p style="text-align: right;">Answer: 563      [2]      [A1]</p>	<p><i>For Examiner's Use</i></p>										
<p>8.</p>	<p>Solve the following equations:</p> <p>(a) <math>3x^2 + 5x + 2 = 0</math></p> <p>(b) <math>\frac{2}{x+4} + \frac{1}{x^2-16} = 0</math></p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 20px;"> <p>(a) <math>3x^2 + 5x + 2 = 0</math>  <math>(3x + 2)(x + 1) = 0</math> [M1]  <math>x = -\frac{2}{3}</math> or <math>-1</math></p> </div> <table style="border-collapse: collapse; margin: 0 auto;"> <tr> <td style="border-right: 1px solid black; padding: 5px;"><math>3x</math></td> <td style="padding: 5px;"><math>+ 2</math></td> <td style="border-left: 1px solid black; padding: 5px;"><math>+ 2x</math></td> <td rowspan="3" style="padding: 0 10px;">[M1]</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;"><math>x</math></td> <td style="padding: 5px;"><math>+ 1</math></td> <td style="border-left: 1px solid black; padding: 5px;"><math>+ 3x</math></td> </tr> <tr style="border-top: 1px solid black;"> <td style="border-right: 1px solid black; padding: 5px;"><math>3x^2</math></td> <td style="padding: 5px;"><math>2</math></td> <td style="border-left: 1px solid black; padding: 5px;"><math>+ 5x</math></td> </tr> </table> </div> <p>(b) <math>\frac{2}{x+4} + \frac{1}{x^2-16} = 0</math></p> $\frac{2}{x+4} + \frac{1}{(x+4)(x-4)} = 0$ $\frac{2(x-4)+1}{(x+4)(x-4)} = 0 \quad [M1]$ $\frac{2x-8+1}{(x+4)(x-4)} = 0 \quad [M1]$ $\frac{2x-7}{(x+4)(x-4)} = 0$ $2x-7 = 0$ $x = 3\frac{1}{2}$ <p style="text-align: right;">Answer: (a) <math>x = -\frac{2}{3}</math> or <math>-1</math>      [3]      [A1]</p> <p style="text-align: right;">(b) <math>x = 3\frac{1}{2}</math>      [3]      [A1]</p>	$3x$	$+ 2$	$+ 2x$	[M1]	$x$	$+ 1$	$+ 3x$	$3x^2$	$2$	$+ 5x$	
$3x$	$+ 2$	$+ 2x$	[M1]									
$x$	$+ 1$	$+ 3x$										
$3x^2$	$2$	$+ 5x$										

9. An object is formed by combining a hemisphere with a cone. Given that the radius and the height of the cone is 7cm and 10cm respectively, calculate the
- (a) value of  $l$ ,
- (b) total surface area of the object,
- (c) volume of the object.



(a)  $l^2 = 7^2 + 10^2$  [M1]

$l = \sqrt{149} = 12.2\text{cm}$

- (b) Surface area of hemisphere

$= \frac{1}{2} * 4\pi r^2$

$= \frac{1}{2} * 4\pi(7)^2$  [M1]

$= 307.876\text{cm}^2$

Surface area of cone

$= \pi r l$

$= \pi(7)(\sqrt{149})$  [M1]

$= 268.436\text{cm}^2$

Total surface area

$= 307.876 + 268.436$

$= 576.312$

$= 576\text{cm}^2$

Volume of hemisphere

$= \frac{1}{2} * \frac{4}{3} \pi r^3$

$= \frac{1}{2} * \frac{4}{3} \pi(7)^3$  [M1]

$= 718.378\text{cm}^3$

Volume of cone

$= \frac{1}{3} \pi r^2 h$

$= \frac{1}{3} \pi(7)^2(10)$  [M1]

$= 513.127\text{cm}^3$

Total volume

$= 718.378 + 513.127$

$= 1231.505$

$= 1230\text{cm}^3$

Answer: (a) 12.2cm [2] [A1]

(b) 576cm<sup>2</sup> [3] [A1]

(c) 1230cm<sup>3</sup> [3] [A1]

**10.**  $PQRS$  is formed by 2 right angled triangles.  $\angle PRQ = \angle PRS = 90^\circ$ .  $PQ = 12\text{cm}$ ,  $PR = 11\text{cm}$  and  $RS = 7\text{cm}$ .

- (a) Show that (i)  $QR^2 = 23\text{cm}^2$ ,  
(ii)  $PS^2 = 170\text{cm}^2$ .

(b) Hence, find the area of  $\Delta PQS$ .

(a)(i)  $12^2 = QR^2 + 11^2$   
 $QR^2 = 12^2 - 11^2$   
 $= 23\text{cm}^2$  (shown)

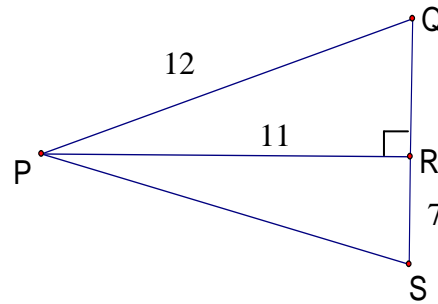
(ii)  $PS^2 = 11^2 + 7^2$   
 $= 170\text{cm}^2$  (shown)

(b)  $QR = \sqrt{23}\text{cm}$

$QS = (\sqrt{23} + 7)\text{cm}$

Area of  $\Delta PQS$

$= \frac{1}{2} * b * h = \frac{1}{2} (\sqrt{23} + 7)(11) = 64.9\text{cm}^2$



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Answer: (a)(i).....(show above).....[1]

[A1]

(ii).....(show above).....[1]

[A1]

(b)  $64.9\text{cm}^2$  [1]

[A1]

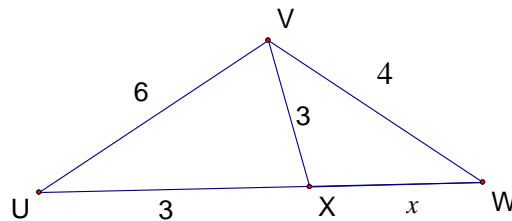
**11.** Triangles  $UVW$  and  $VXW$  are similar.

$UV = 6\text{cm}$ ,  $VX = 3\text{cm}$  and  $VW = 4\text{cm}$ .

Find the length of  $WX$ .

$\frac{WX}{3} = \frac{4}{6}$  [M1]

$WX = 2 \times 3 = 6\text{cm}$



Answer:  $6\text{cm}$

[2]

[A1]

<p><b>12.</b></p>	<p>A is directly proportional to <math>r^2</math>. Given that <math>A = 3</math>, <math>r = 4</math>,</p> <p>(a) form an equation relating A and r,  (b) find the value of A when <math>r = 6</math>,  (c) find the values of r when <math>A = 5</math>.</p> <p>(a) <math>A = kr^2</math>  <math>3 = k(4)^2</math> [M1]  <math>k = \frac{3}{16}</math>  <math>A = \frac{3}{16}r^2</math></p> <p>(b) When <math>r = 6</math>,  <math>A = \frac{3}{16}(6)^2</math> [M1]  <math>= 6\frac{3}{4}</math></p> <p>(c) When <math>A = 5</math>,  <math>5 = \frac{3}{16}r^2</math> [M1]  <math>r^2 = 5 * \frac{16}{3}</math>  <math>r = \pm 5.16</math></p> <p>Answer: (a) <math>A = \frac{3}{16}r^2</math> [2]  (b) <math>6\frac{3}{4}</math> [2]  (c) <math>\pm 5.16</math> [2]</p>	<p style="text-align: right;"><i>For Examiner's Use</i></p> <p>[A1] [A1] [A1]</p>																				
<p><b>13.</b></p>	<p>The mass of 30 fishes were measured.</p> <p>(a) Complete the following table. [3]</p> <table border="1"> <thead> <tr> <th>Mass (g)</th> <th>Mid value (x)</th> <th>Frequency (f)</th> <th>fx</th> </tr> </thead> <tbody> <tr> <td><math>100 &lt; x \leq 200</math></td> <td>150</td> <td>8</td> <td>1200</td> </tr> <tr> <td><math>200 &lt; x \leq 300</math></td> <td>250</td> <td>10</td> <td>2500</td> </tr> <tr> <td><math>300 &lt; x \leq 400</math></td> <td>350</td> <td>12</td> <td>4200</td> </tr> <tr> <td colspan="2"></td> <td><math>\Sigma f = 30</math> [A1]</td> <td><math>\Sigma fx = 7900</math> [A1]</td> </tr> </tbody> </table> <p>(b) Find the mean mass of the fishes.</p> <p>Mean = <math>\frac{7900}{30}</math>  263.3  263g</p> <p>Answer: 263g [1]</p>	Mass (g)	Mid value (x)	Frequency (f)	fx	$100 < x \leq 200$	150	8	1200	$200 < x \leq 300$	250	10	2500	$300 < x \leq 400$	350	12	4200			$\Sigma f = 30$ [A1]	$\Sigma fx = 7900$ [A1]	<p>[M1] [A1]</p>
Mass (g)	Mid value (x)	Frequency (f)	fx																			
$100 < x \leq 200$	150	8	1200																			
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$300 < x \leq 400$	350	12	4200																			
		$\Sigma f = 30$ [A1]	$\Sigma fx = 7900$ [A1]																			