

## Equations, Inequations & Algebra

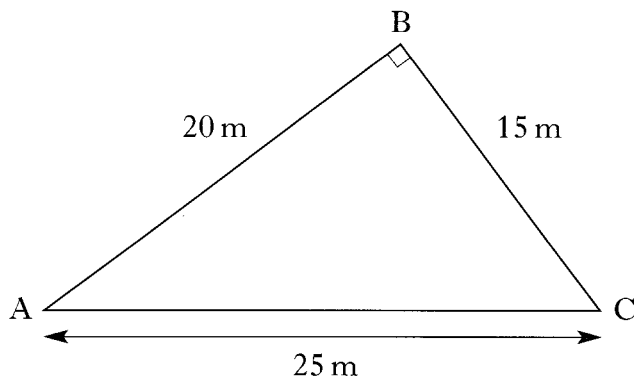
2008 PI	<p><b>10.</b> To hire a car costs £25 per day plus a mileage charge. The first 200 miles are free with each additional mile charged at 12 pence.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: 80%; text-align: center;"> <h3 style="margin: 0;">CAR HIRE</h3> <p style="margin: 5px 0;"><b>£25 per day</b></p> <ul style="list-style-type: none"> <li>• <b>first 200</b> miles free</li> <li>• each additional mile only 12p</li> </ul> </div> <p>(a) Calculate the cost of hiring a car for 4 days when the mileage is 640 miles.</p> <p>(b) A car is hired for <math>d</math> days and the mileage is <math>m</math> miles where <math>m &gt; 200</math>. Write down a formula for the cost £<math>C</math> of hiring the car.</p>	1	3
Ans	(a) £152.80    (b) $C = 25d + 0.12m - 24$		
2008 PI	<p><b>3.</b> <math>W = BH^2</math>.</p> <p>Change the subject of the formula to <math>H</math>.</p>	2	
Ans	$H = \sqrt{\frac{W}{B}}$		

2008 PI	<p>6. Jane enters a two-part race.</p> <p>(a) She cycles for 2 hours at a speed of <math>(x + 8)</math> kilometres per hour. Write down an expression in <math>x</math> for the distance cycled.</p> <p>(b) She then runs for 30 minutes at a speed of <math>x</math> kilometres per hour. Write down an expression in <math>x</math> for the distance run.</p> <p>(c) The <b>total</b> distance of the race is 46 kilometres. Calculate Jane's <b>running</b> speed.</p>	1	1	3
Ans	$(a) 2(x+8) \quad (b) 0.5x \quad (c) 12 \text{ km/h.}$			
2008 PI	<p>7. The 4th term of each number pattern below is the <b>mean</b> of the previous three terms.</p> <p>(a) When the first three terms are 1, 6, and 8, calculate the 4th term.</p> <p>(b) When the first three terms are <math>x</math>, <math>(x + 7)</math> and <math>(x + 11)</math>, calculate the 4th term.</p> <p>(c) When the first, second and fourth terms are  <math>-2x</math>, <math>(x + 5)</math>, <math>\text{---}</math>, <math>(2x + 4)</math>,            calculate the 3rd term.</p>	1	1	2
Ans	$(a) 5 \quad (b) x + 6 \quad (c) 7x + 7$			
2008 PI	<p>12. Given that</p> $x^2 - 10x + 18 = (x - a)^2 + b,$ <p>find the values of <math>a</math> and <math>b</math>.</p>	3		
Ans	$a = 5 \quad , \quad b = -7$			
2008 PI	<p>13. A new fraction is obtained by adding <math>x</math> to the numerator and denominator of the fraction <math>\frac{17}{24}</math>.</p> <p>This new fraction is equivalent to <math>\frac{2}{3}</math>.</p> <p>Calculate the value of <math>x</math>.</p>			3
Ans	$x = -3$			

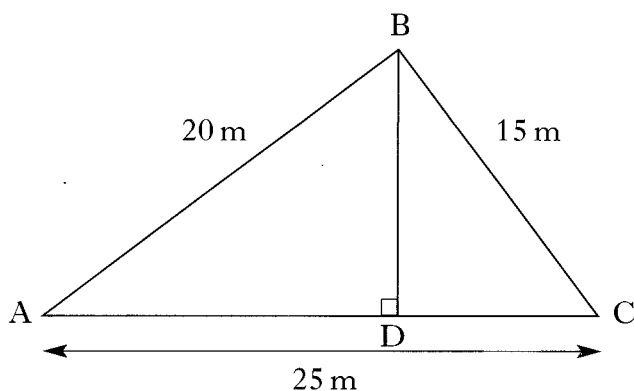
2007 P1	<p>4.</p> $P = \frac{2(m-4)}{3}$ <p>Change the subject of the formula to <math>m</math>.</p>	3	
Ans	$m = \frac{3P+8}{2}$ or $m = \frac{3P}{2} + 4$		
2007 P1	<p>5. Remove brackets and simplify</p> $(2x+3)^2 - 3(x^2-6).$	3	
Ans	$x^2+12x+27$		
2007 P1	<p>14. The <b>sum</b> <math>S_n</math> of the first <math>n</math> terms of a sequence, is given by the formula</p> $S_n = 3^n - 1.$ <p>(a) Find the <b>sum</b> of the first 2 terms.</p> <p>(b) When <math>S_n = 80</math>, calculate the value of <math>n</math>.</p>	1	2
Ans	(a) 8 (b) 4		
2007 P2	<p>4. Solve the inequality</p> $\frac{x}{4} - \frac{1}{2} < 5.$	2	
Ans	$x < 22$		
2006 P1	<p>6. Solve the equation</p> $x - 2(x+1) = 8.$	3	
Ans	-10		

10. Triangle ABC is right-angled at B.

The dimensions are as shown.



- (a) Calculate the area of triangle ABC.
- (b) BD, the height of triangle ABC, is drawn as shown.



Use your answer to part (a) to calculate the height BD.

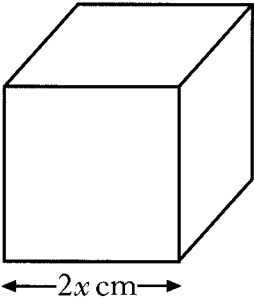
2006 P1

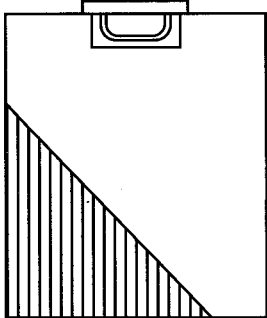
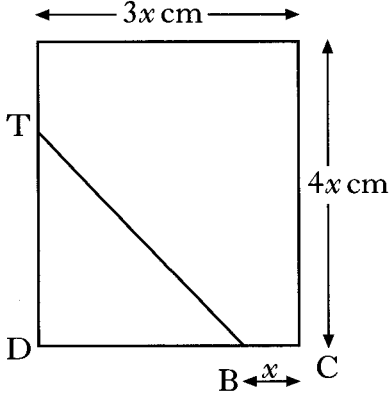
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3

Ans (a)  $150\text{m}^2$  (b) 12m

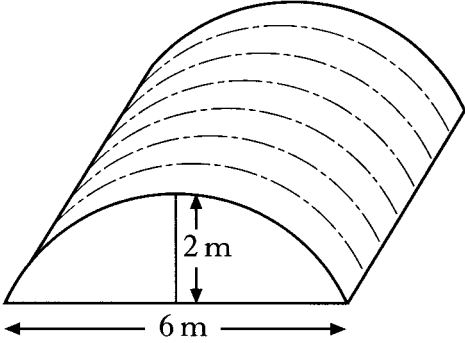
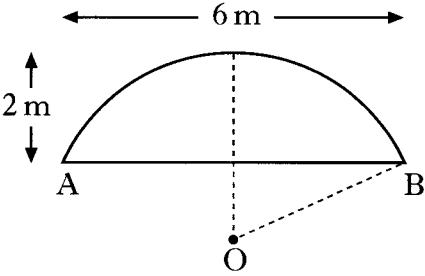
2006 P1	<p><b>11. (a)</b> One session at the Leisure Centre costs £3.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto; text-align: center;"> <p><b>£3 per session</b></p> </div> <p>Write down an algebraic expression for the cost of <math>x</math> sessions.</p>		1
	<p><b>(b)</b> The Leisure Centre also offers a monthly card costing £20. The <b>first 6</b> sessions are then free, with each additional session costing £2.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto; text-align: center;"> <p><b>Monthly card £20</b></p> <p>* <u>first 6</u> sessions free * each additional session £2</p> </div>		
	<p>(i) Find the <b>total</b> cost of a monthly card and 15 sessions.</p> <p>(ii) Write down an algebraic expression for the <b>total</b> cost of a monthly card and <math>x</math> <b>sessions</b>, where <math>x</math> is greater than 6.</p>	1	2
	<p>(c) Find the minimum number of sessions required for the monthly card to be the cheaper option.</p> <p><b>Show all working.</b></p>		3
<i>Ans</i>	(a) $3x$ (b)(i) £38    (ii) $2x + 8$ (c) 9		
2006 P2	<p><b>4. (a)</b> Expand and simplify</p> <p style="text-align: center;"><math>(x + 4)(3x - 1)</math>.</p>		1
	<i>Ans</i>	$3x^2 + 11x - 4$	

2005 P1	<p>6. Solve the equation</p> $\frac{2}{x} + 1 = 6.$	3	
Ans	$\frac{2}{5}$		
2005 P1	<p>9. (a) Emma puts £30 worth of petrol into the empty fuel tank of her car.</p> <p>Petrol costs 75 pence per litre. Her car uses 5 litres of petrol per hour, when she drives at a particular constant speed.</p> <p>At this constant speed, how many litres of petrol will remain in the car after 3 hours.</p> <p>(b) The next week, Emma puts £20 worth of petrol into the empty fuel tank of her car.</p> <p>Petrol costs <math>c</math> pence per litre. Her car uses <math>k</math> litres of petrol per hour, when she drives at another constant speed.</p> <p>Find a formula for <math>R</math>, the amount of petrol remaining in the car after <math>t</math> hours.</p>	2	3
Ans	(a) 25 litres    (b) $R = \frac{2000}{c} - kt$		
2005 P2	<p>8. The side length of a cube is <math>2x</math> centimetres.</p> <div style="text-align: center;">  </div> <p>The expression for the volume in cubic centimetres is equal to the expression for the surface area in square centimetres.</p> <p>Calculate the side length of the cube.</p>	5	
Ans	6cm		

2004 P1	<p><b>3.</b> <math>A = 2x^2 - y^2</math>.</p> <p>Calculate the value of A when <math>x = 3</math> and <math>y = -4</math>.</p>	2	
Ans	2		
2003 P1	<p><b>3.</b> Simplify <math>3(2x - 4) - 4(3x + 1)</math>.</p>	3	
Ans	-6x - 16		
2003 P1	<p><b>13.</b> A rectangular clipboard has a triangular plastic pocket attached as shown in Figure 1.</p> <div style="text-align: right; margin-right: 100px;">  <p style="text-align: center;">Figure 1</p> </div> <p>The pocket is attached along edges TD and DB as shown in Figure 2.</p> <p>B is <math>x</math> centimetres from the corner C.</p> <div style="text-align: right; margin-right: 100px;">  <p style="text-align: center;">Figure 2</p> </div> <p>The length of the clipboard is <math>4x</math> centimetres and the breadth is <math>3x</math> centimetres.</p> <p>The area of the pocket is a quarter of the area of the clipboard.</p> <p>Find, in terms of <math>x</math>, the length of TD.</p>	4	
Ans	TD = 3x		

2003 P2	<p>5. The number of diagonals, <math>d</math>, in a polygon with <math>n</math> sides is given by the formula</p> $d = \frac{n(n-3)}{2}.$ <p>A polygon has 20 diagonals. How many sides does it have?</p>		4
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Ans 8

2003 P2	<p>10. A sheep shelter is part of a cylinder as shown in Figure 1.</p> <p>It is 6 metres wide and 2 metres high.</p> <div style="text-align: center;">  <p>Figure 1</p> </div> <p>The cross-section of the shelter is a segment of a circle with centre <math>O</math>, as shown in Figure 2.</p> <p><math>OB</math> is the radius of the circle.</p> <div style="text-align: center;">  <p>Figure 2</p> </div> <p>Calculate the length of <math>OB</math>.</p>		4
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Ans 3.25m

2002 P1	<p>3. Solve the inequality <math>5 - x &gt; 2(x + 1)</math>.</p>		3
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Ans  $x < 3$



2002 P1	<p>6. <math>L = \frac{1}{2}(h - t)</math>. Change the subject of the formula to <math>h</math>.</p>	2	
Ans	$h = 2L + t$		
2002 P2	<p>9. Esther has a new mobile phone and considers the following daily rates.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="border: 1px solid black; padding: 10px; width: 45%; text-align: center;"> <p><b>Easy Call</b></p> <p>25 pence per minute for the first 3 minutes</p> <p>5 pence per minute <b>after</b> the first three minutes</p> </div> <div style="border: 1px solid black; padding: 10px; width: 45%; text-align: center;"> <p><b>Green Call</b></p> <p>40 pence per minute for the first 2 minutes</p> <p>2 pence per minute <b>after</b> the first two minutes</p> </div> </div> <p>(a) For Easy Call, find the cost of ten minutes in a day.</p> <p>(b) For Easy Call, find a formula for the cost of “m” minutes in a day, <math>m &gt; 3</math>.</p> <p>(c) For Green Call, find a formula for the cost of “m” minutes in a day, <math>m &gt; 2</math>.</p> <p>(d) Green Call claims that its system is cheaper. Find <b>algebraically</b> the least number of minutes (to the nearest minute) which must be used each day for this claim to be true.</p>	1	1
Ans	<p>9. (a) 110p (b) <math>c = 75 + 5(m - 3)</math> (c) <math>c = 80 + 2(m - 2)</math> (d) 6 minutes</p>		3
2001 P1	<p>4. Solve <b>algebraically</b> the equation</p> $2x - \frac{(3x - 1)}{4} = 4.$		3
Ans	$x = 3$		

2000 PI	<b>8.</b> Solve <b>algebraically</b> the inequality $2y < 3 - (y + 6).$	3	
Ans	$y < -1$		