

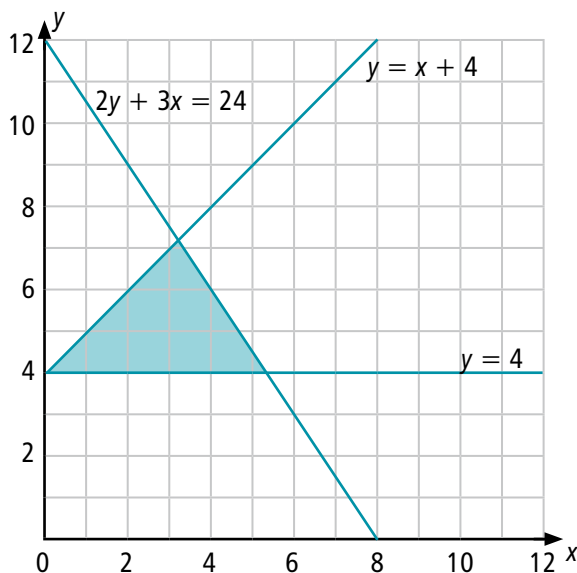
**Achievement Standard 91269 (Mathematics and Statistics 2.14)**

**Apply systems of equations in solving problems**

**Practice assessment**

**Solutions**

1. a.



b. Using substitution to solve simultaneously:

$y = 4$  and  $y = x + 4$  meet when  $x + 4 = 4$ , so  $x = 0$  giving the point  $(0, 4)$

$y = 4$  and  $2y + 3x = 24$  meet when  $8 + 3x = 24$ , so  $x = \frac{16}{3}$  giving the point  $(5\frac{1}{3}, 4)$

$y = x + 4$  and  $2y + 3x = 24$  meet when  $2(x + 4) + 3x = 24$ , so  $5x + 8 = 24$  and  $x = 3.2$

Substituting  $x = 3.2$  in  $y = x + 4$  gives  $y = 7.2$ . So the point of intersection is  $(3.2, 7.2)$

So the points of intersection are  $(0, 4)$ ,  $(5\frac{1}{3}, 4)$ ,  $(3.2, 7.2)$

c. Maximum values occur at vertices.

Vertex $(x, y)$	$2y + x$
$(0, 4)$	$8 + 0 = 8$
$(5\frac{1}{3}, 4)$	$8 + 5\frac{1}{3} = 13\frac{1}{3}$
$(3.2, 7.2)$	$14.4 + 3.2 = 17.6$

$2y + x$  is maximised by the point  $(3.2, 7.2)$ . The maximum value is 17.6

2. a. Substituting gives  $x - 2 = \frac{6}{x - 2}$

$$(x - 2)^2 = 6$$

$$x^2 - 4x + 4 = 6$$

$$x^2 - 4x - 2 = 0$$

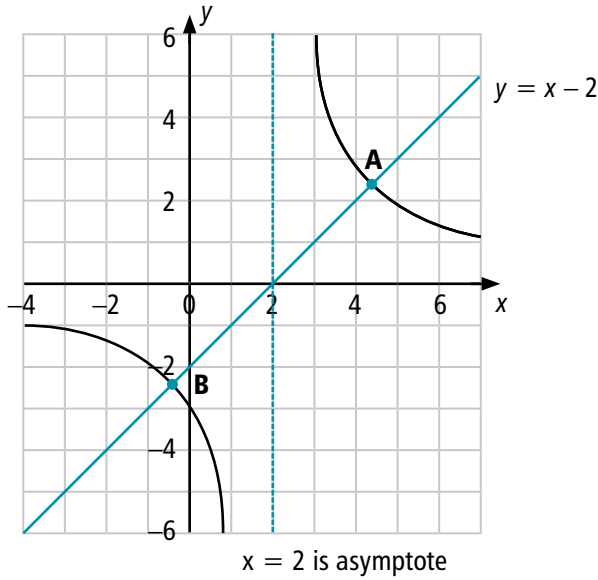
Using the quadratic formula, or by calculator,  $x = 4.449$  or  $x = -0.449$

Substituting  $x = 4.449$  in  $y = x - 2$  gives  $y = 2.449$

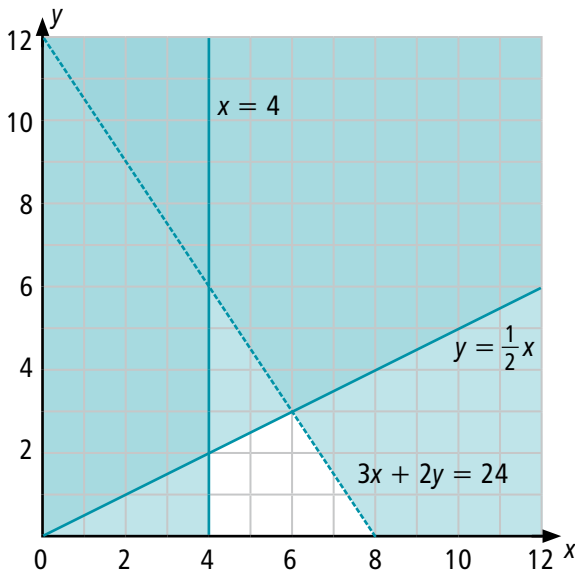
Substituting  $x = -0.449$  in  $y = x - 2$  gives  $y = -2.449$

So the points of intersection are  $(4.449, 2.449)$  and  $(-0.449, -2.449)$

b.



3. a. For the constraint  $3x + 2y < 24$   
 Boundary line  $3x + 2y = 24$  has intercepts  $(0,12)$  and  $(8,0)$   
 Testing  $(0,0)$  gives  $0 < 24$  (true) so shade out points above line  
 For the constraint  $2y \leq x$   
 Boundary line  $2y = x$  rearranges to  $y = \frac{1}{2}x$ , which is a line through  $(0,0)$  with gradient  $\frac{1}{2}$   
 Testing  $(1,1)$  gives  $2 \leq 1$  (false) so shade out points above line  
 For the constraint  $x \geq 4$   
 Boundary line is the vertical line  $x = 4$   
 Testing  $(0,0)$  gives  $0 \geq 4$  (false) so shade out points left of line.  
 The graph is as shown.



- b. Reading coordinates from graph, the points are:  
 $(4,0), (4,1), (4,2), (5,0), (5,1), (5,2), (6,0), (6,1), (6,2), (7,0), (7,1)$   
 c. Highest score is at  $(7,1)$  with a score of  $7 \times 3 + 1 \times 2 = 23$