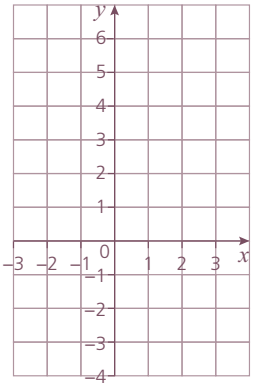
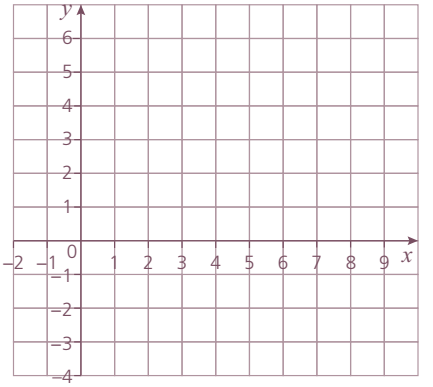
3 Equations, inequalities and graphs

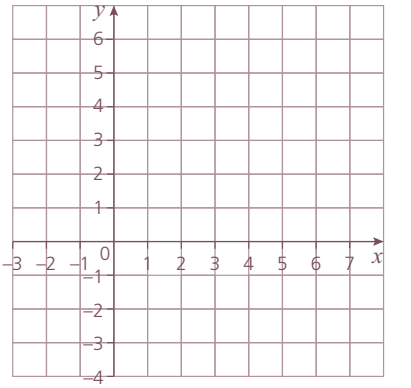
1 a) Plot the graphs of $y = 3x$ and $y = |3x|$ on the same axes.



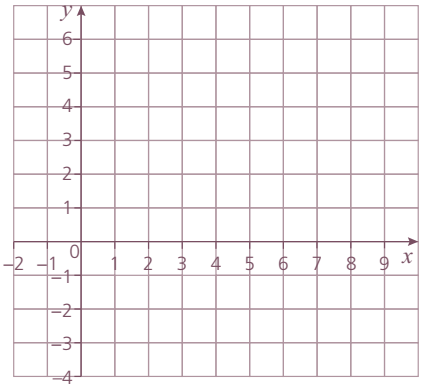
b) Plot the graphs of $y = x - 4$ and $y = |x - 4|$ on the same axes.



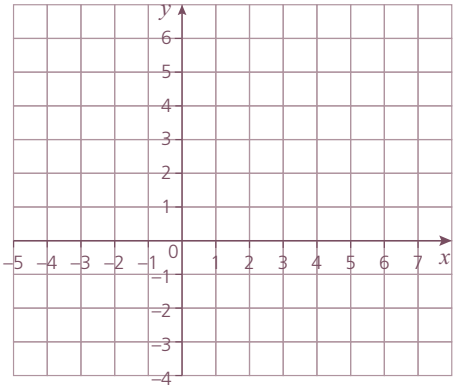
c) Plot the graphs of $y = 2x - 4$ and $y = |2x - 4|$ on the same axes.



d) Plot the graphs of $y = 5 - x$ and $y = |5 - x|$ on the same axes.



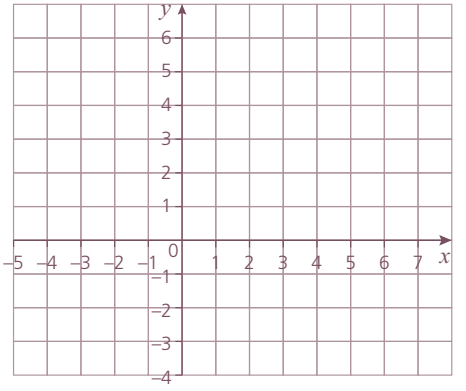
2 **a)** On the axes below, draw the graph of $y = |x + 2|$.



b) Use the graph to solve $|x + 2| = 2$.

c) Use algebra to verify your answer to **b)**.

3 **a)** On the axes below, draw the graph of $y = |2x – 3|$.

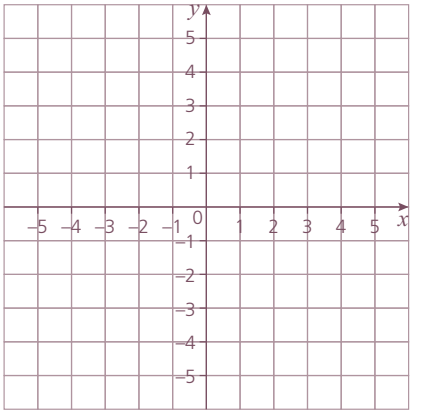


b) Use the graph to solve $|2x – 3| = 1$.

c) Use algebra to verify your answer to **b)**.

4 Solve the equation $|x – 2| = |x + 2|$

a) graphically

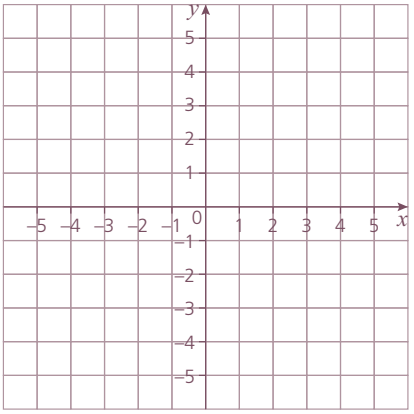


b) algebraically.

5 Solve the equation $|2x + 3| = |2x - 3|$

a) graphically

b) algebraically.



6 Write each of the following inequalities in the form $|x - a| \leqslant b$:

a) $-2 \leqslant x \leqslant 12$

b) $-5 \leqslant x \leqslant 25$

c) $-16 \leqslant x \leqslant 8$.

7 Write each of the following expressions in the form $a \leqslant x \leqslant b$.

a) $|x + 1| \leqslant 3$

b) $|x + 2| \leqslant 4$

c) $|x + 3| \leqslant 5$

8 **(i)** Solve the following inequalities and **(ii)** illustrate the solution on a number line:

a) $|x + 1| < 5$

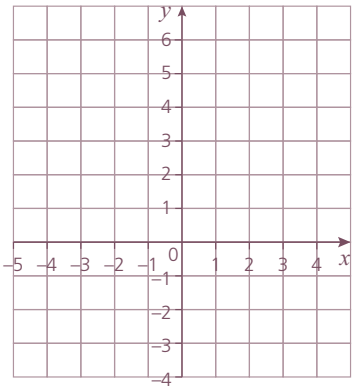
b) $|x + 1| > 5$

c) $|3x + 2| \leqslant 7$

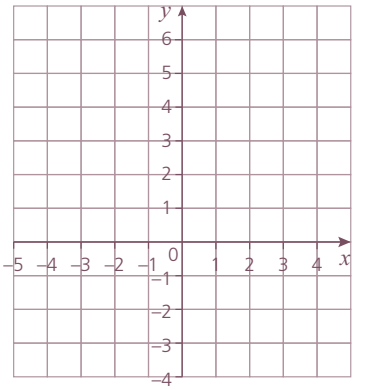
d) $|3x + 2| \geqslant 7$

9 Illustrate the following inequalities by shading out the unwanted region:

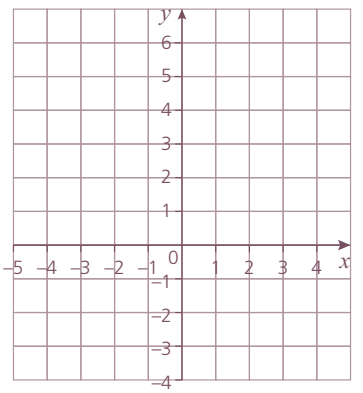
a) $y + 2x < 0$



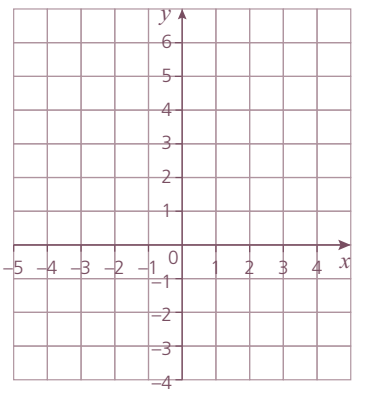
c) $2y - 3x < 0$



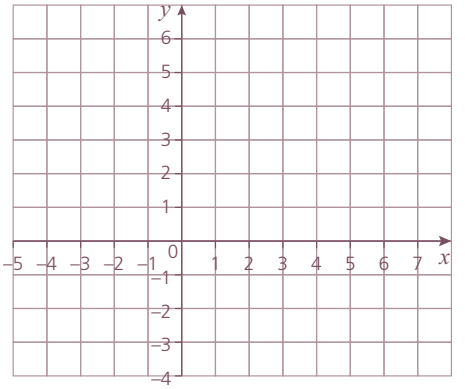
b) $y - 2x > 0$



d) $2y + 3x > 0$



10 a) Draw the lines $y = x - 3$ and $y = x + 3$ on the grid



b) Hence solve these inequalities

(i) $|x - 3| < |x + 3|$

(ii) $|x - 3| > |x + 3|$

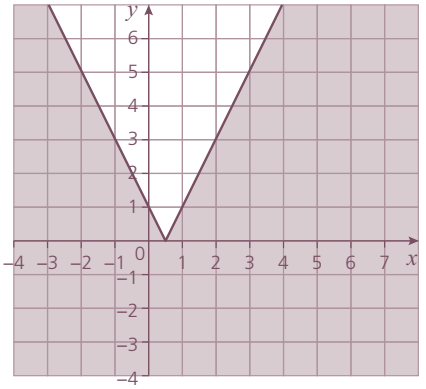
11 Solve the following inequalities algebraically:

a) $|2x - 3| < |x + 3|$

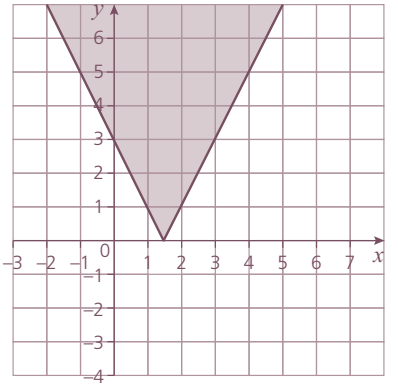
b) $|2x - 3| > |x + 3|$

12 The unshaded region of each graph illustrates an inequality of a modulus function. In each case write the inequality.

a) $y = |2x - 1|$

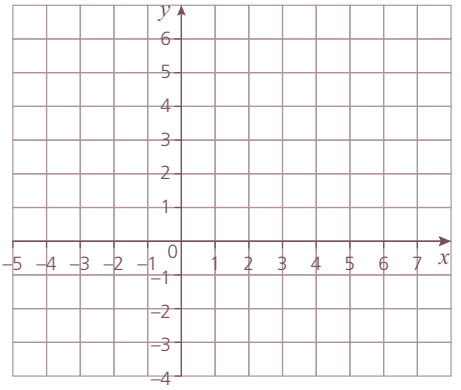


b) $y = |3 - 2x|$

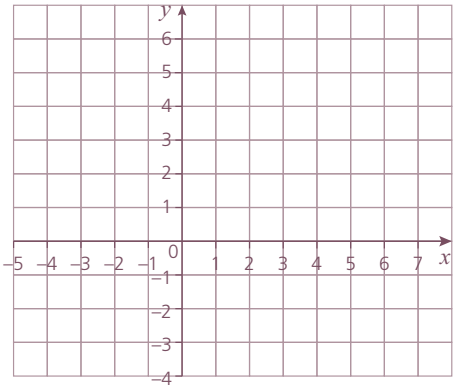


13 Sketch the following graphs on the axes provided, indicating the points where they cross the co-ordinate axes:

a) $y = x(x + 1)(x + 2)$

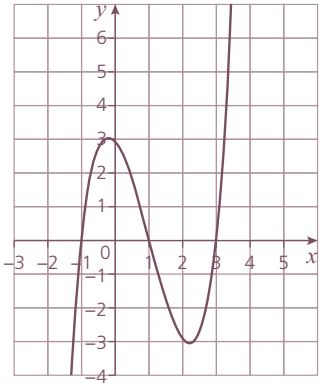


b) $y = |x(x + 1)(x + 2)|$

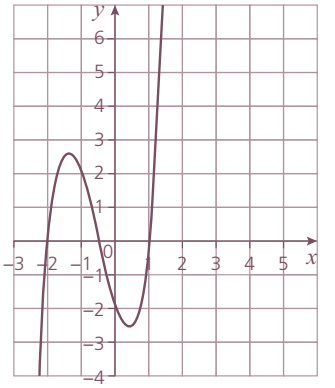


14 Identify the following cubic equations from their graphs:

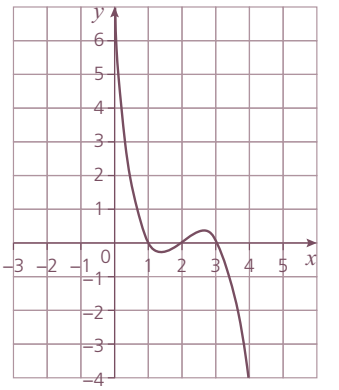
a)



b)

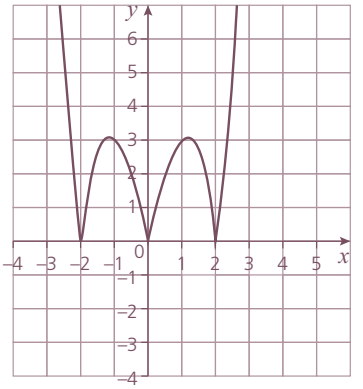


c)

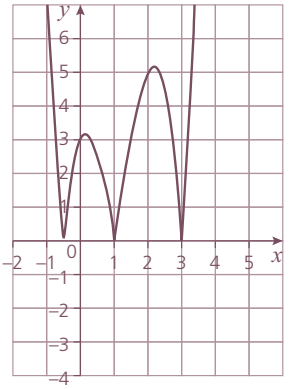


15 Find an equation for each of the following modulus graphs. All represent the moduli of cubic graphs.

a)



b)



c)