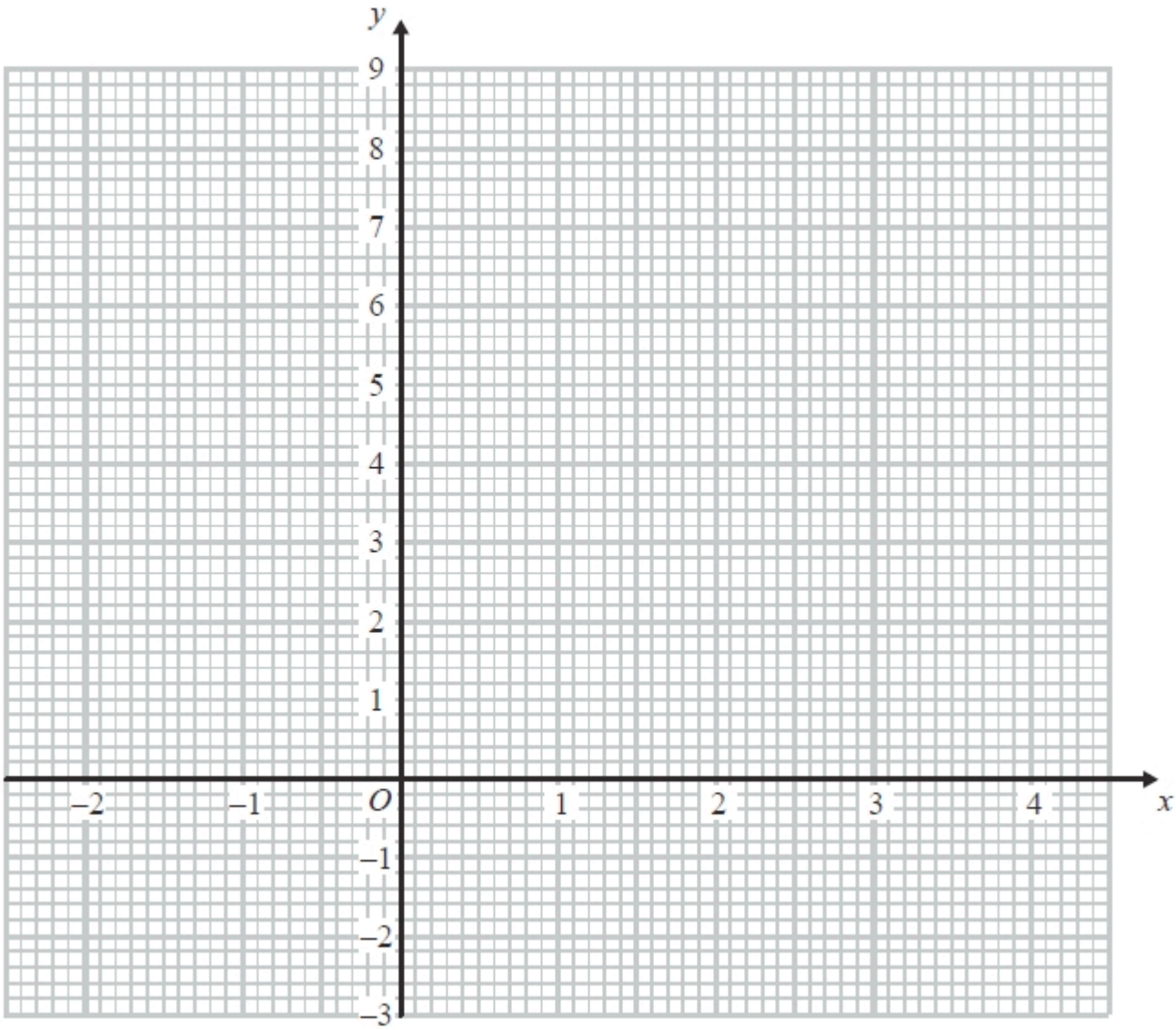
Higher tier unit 15-1 check in test

Calculator

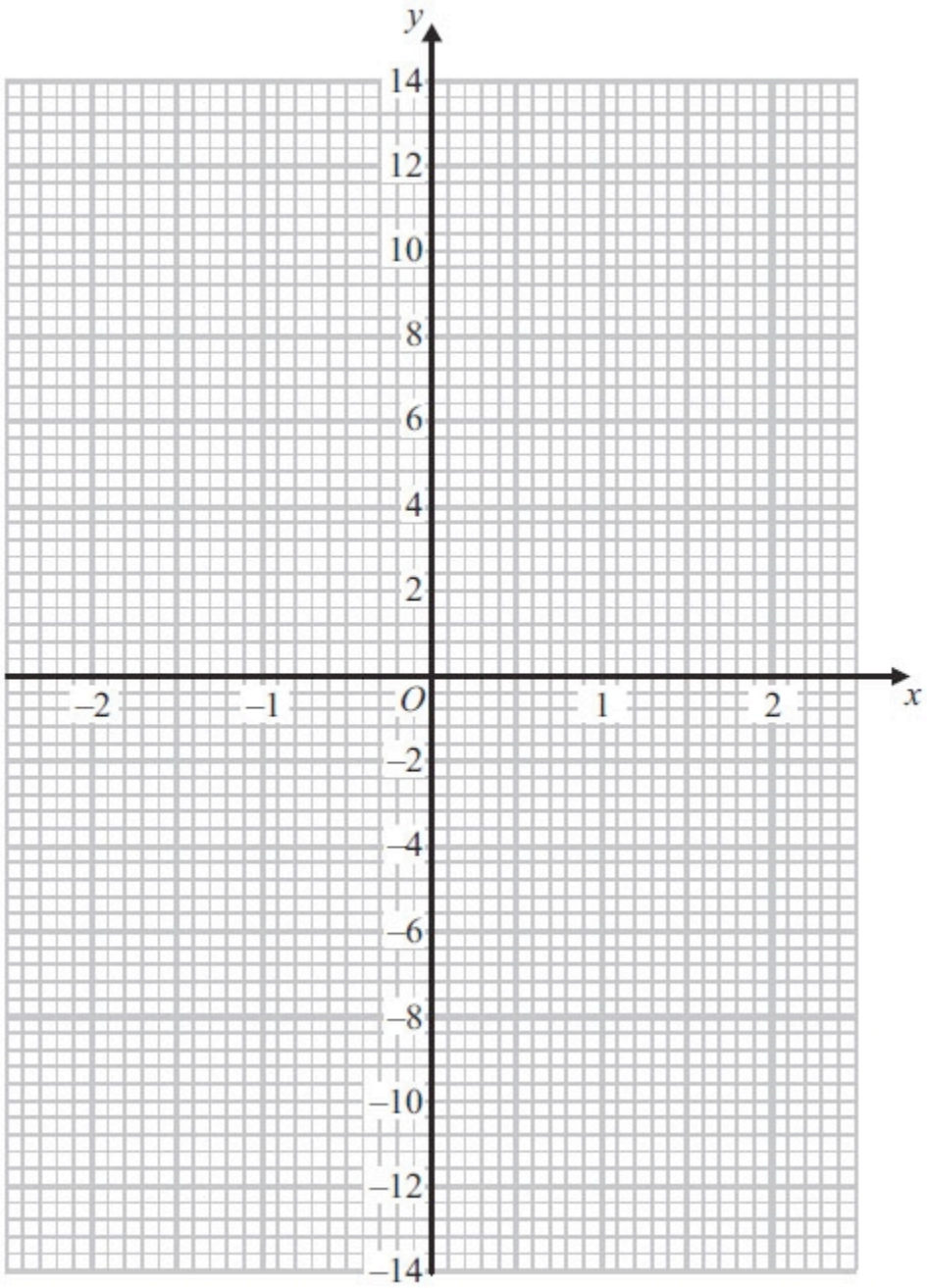
[Q1–2 linked]

Q1. On the grid, draw the graph of $y = x^2 - 2x - 1$ for values of x from –2 to 4

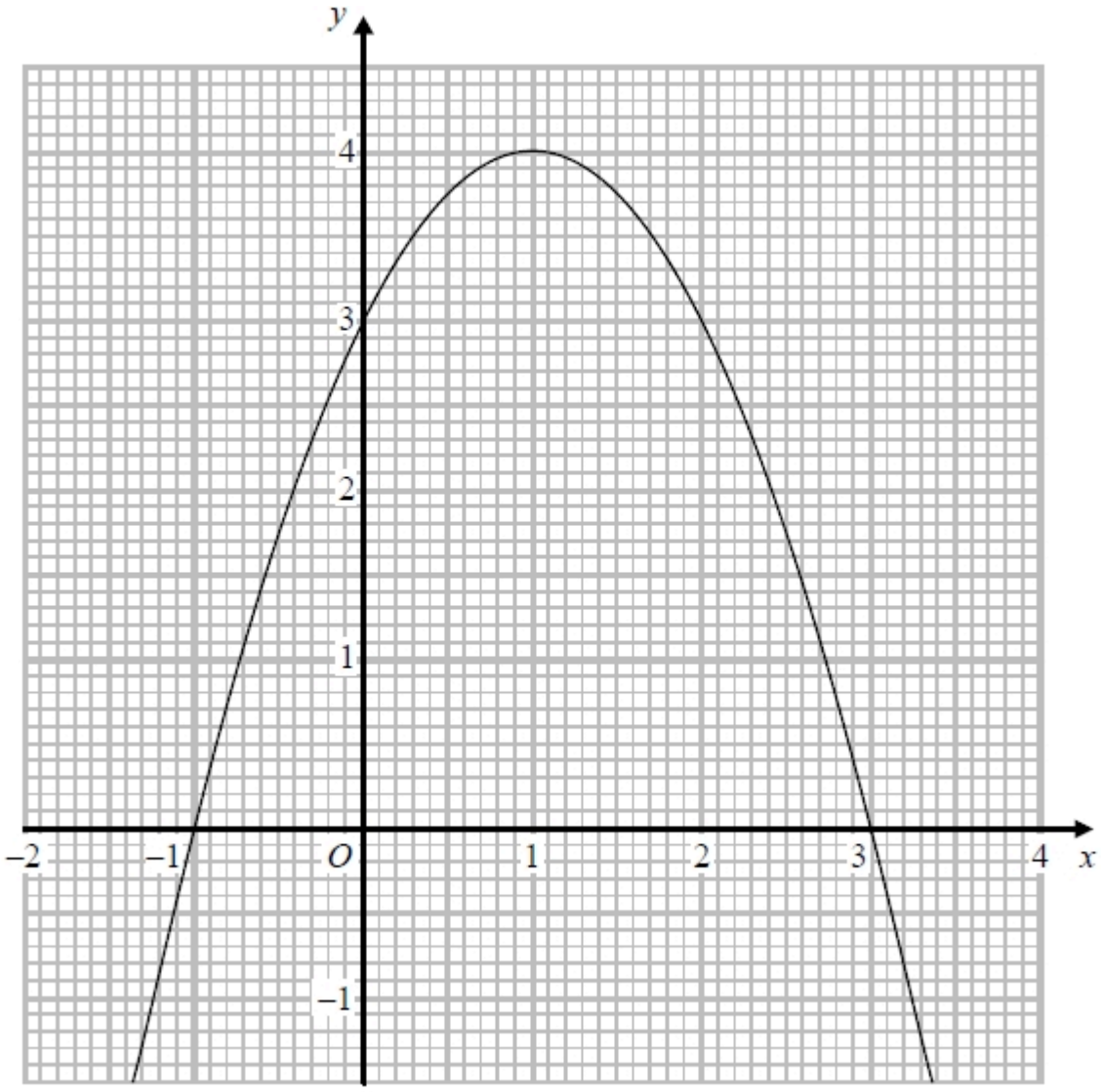


Q2. Using your graph of $y = x^2 - 2x - 1$ from question 1, solve $x^2 - 2x - 1 = x + 3$

Q3. On the grid, draw the graph of $y = x^3 + 2x - 1$ for values of x from –2 to 2

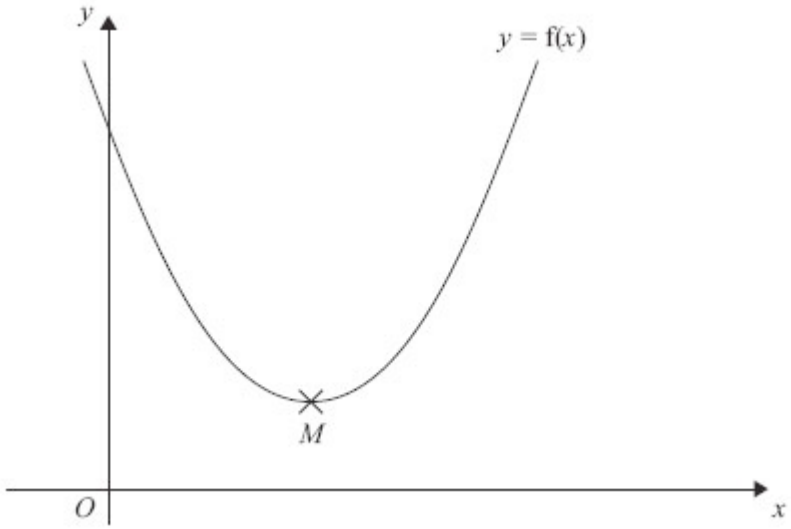


Q4. The graph of $y = f(x)$ is drawn on the grid.



Write down the coordinates of the turning point, and the value of f(0.5).

Q5. The equation of a curve is $y = f(x)$ where $f(x) = x^2 - 8x + 21$
The diagram shows part of a sketch of the graph of $y = f(x)$.

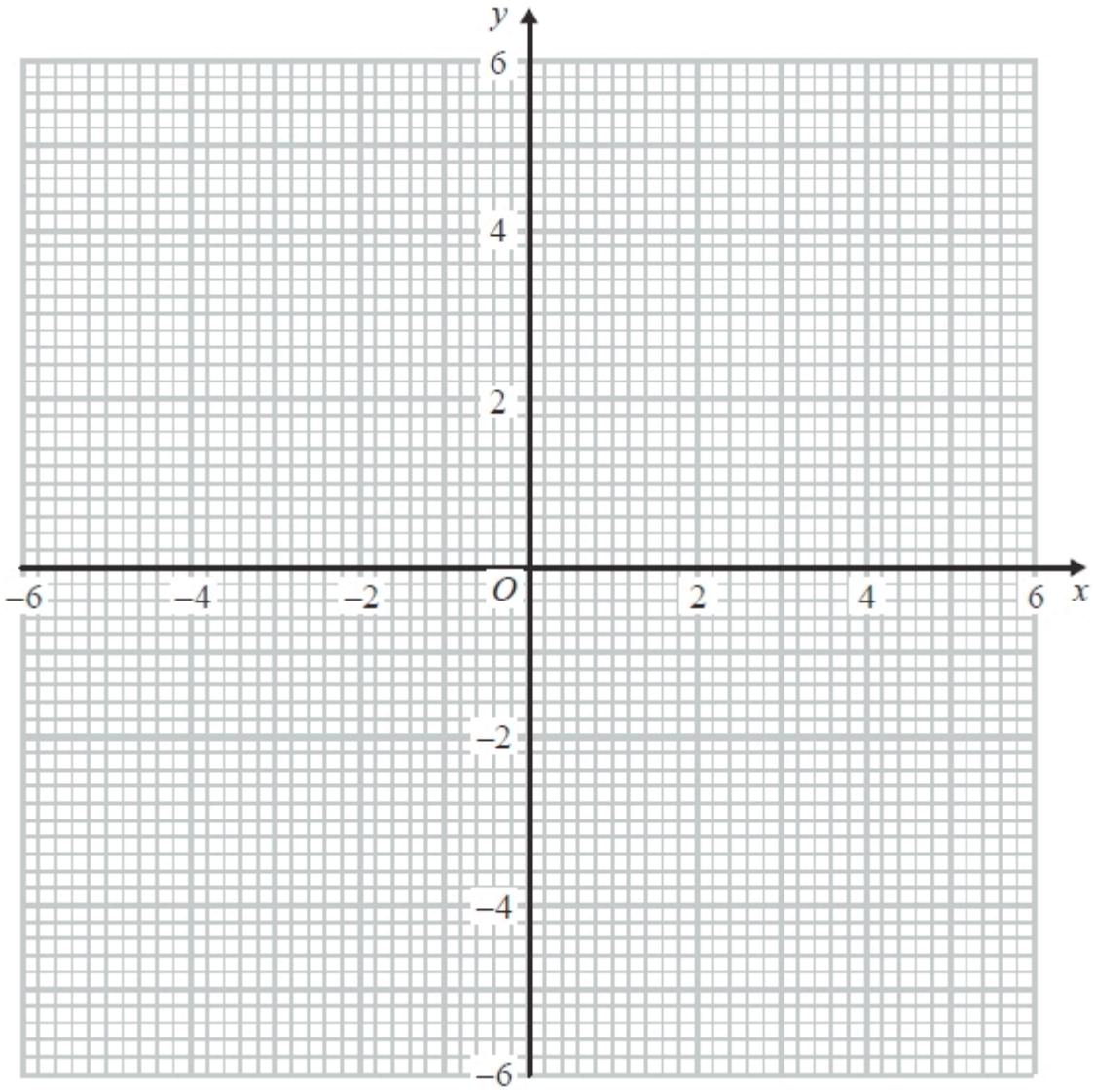


The minimum point of the curve is M.
By writing the expression $x^2 - 8x + 21$ in the form $(x - a)^2 + b$, write down the coordinates of M.

Q6. Expand and simplify $(3x - 1)(x + 5)(4x - 3)$

Q7. Sketch the graph of $y = x^2 - 5x + 10$, showing the coordinates of the turning point and the coordinates of any intercepts with the coordinate axes.

Q8. On the grid, construct the graph of $x^2 + y^2 = 16$.



Use the graph to find estimates for the simultaneous equations

$x^2 + y^2 = 16$

$y = 2x + 1$

Q9. The number of bees in a beehive at the start of year n is P_n.
The number of bees in the beehive at the start of the following year is given by

$$P_{n+1} = 1.05(P_n - 250)$$

At the start of 2015 there were 9500 bees in the beehive.
How many bees will there be in the beehive at the start of 2018?

Q10. The equation $x^3 + 4x = 1$ can be arranged to give $x = \frac{1}{4} \quad \frac{x^3}{4}$.

Use the iteration formula $x_{n+1} = \frac{1}{4} \quad \frac{x_n{}^3}{4}$ twice, to find an estimate for the solution of $x^3 + 4x = 1$

Topics listed in objectives

- Sketch a graph of a quadratic function, by factorising or by using the formula, identifying roots, *y*-intercept and turning point by completing the square;
- Be able to identify from a graph if a quadratic equation has any real roots;
- Find approximate solutions to quadratic equations using a graph;
- Expand the product of more than two linear expressions;
- Sketch a graph of a quadratic function and a linear function, identifying intersection points;
- Sketch graphs of simple cubic functions, given as three linear expressions;
- Solve simultaneous equations graphically:
  - find approximate solutions to simultaneous equations formed from one linear function and one quadratic function using a graphical approach;
  - find graphically the intersection points of a given straight line with a circle;
  - solve simultaneous equations representing a real-life situation graphically, and interpret the solution in the context of the problem;
- Use iteration with simple converging sequences.

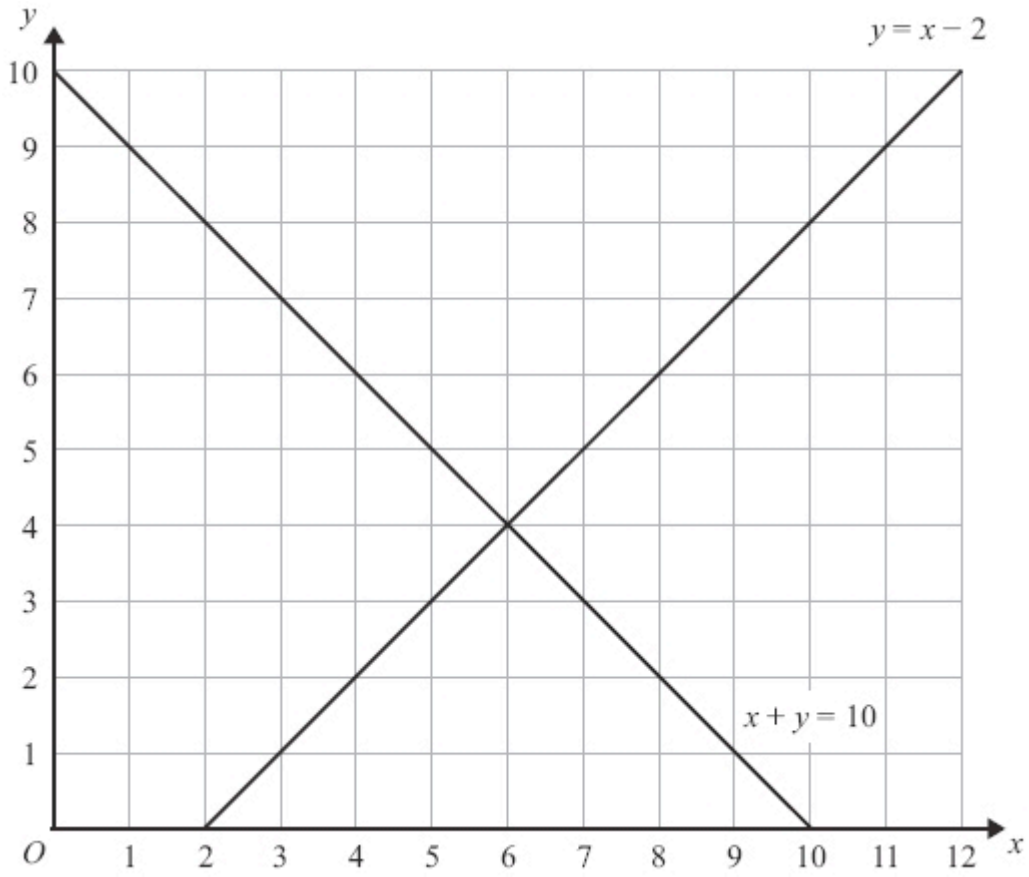
Answers

Q1. correctly drawn graph through (–2, 7), (–1, 2), (0, –1), (1, –2), (2, –1) (3, 2), (4, 7)
Q2. the intersection points at (–1, 2) and (4, 7), so $x = –4$ or 4
Q3. correctly drawn graph through (–2, –13), (–1, 4), (0, –1), (1, 2), (2, 11)
Q4. turning point at (1, 4), f(0.5) = 3.75
Q5. $(x – 4)^2 + 5$, so (4, 5)
Q6. $12x^3 + 47x^2 − 62x + 15$
Q7. sketch of quadratic graph, no intercept with *x*-axis, intercept with *y*-axis at (0, 10), turning point (2.5, 3.75)
Q8. $x = 1.4$, $y = 3.8$, and $x = –2.2$, $y = –3.4$
Q9. 10169 bees
Q10. $x = 0.246$

Higher tier unit 15-2 check in test

Calculator

Q1. The lines $y = x - 2$ and $x + y = 10$ are drawn on the grid.



On the grid, mark with a cross (×) each of the points with integer coordinates that are in the region defined by

$y > x - 2$

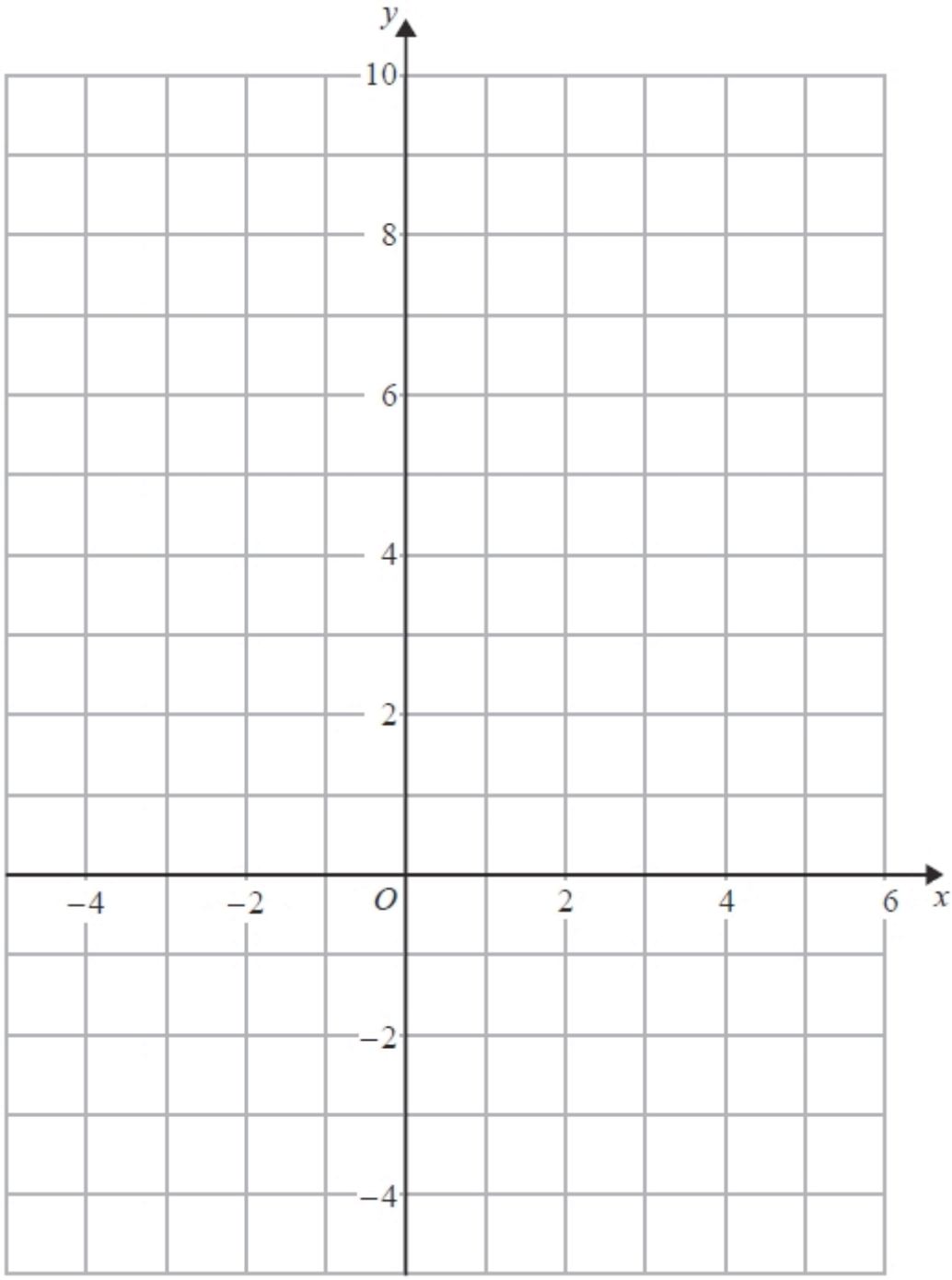
$x + y < 10$

$x > 3$

Q2. On the grid, shade the region that satisfies all these inequalities.

$$x + y < 4 \qquad y > x - 1 \qquad y < 3x$$

Label the region **R**.



Q3. Use a graphical method to find the integer coordinates that satisfy all these inequalities.

$$y - x \leq 4 \qquad y > 2x + 3 \qquad x > -1$$

Q4. Sketch the graph of $y = x^2 + x - 6$.
Write down the values for x where $x^2 + x - 6 < 0$.

Q5. Solve $x^2 > 3x + 4$

Q6. Solve the inequality $x^2 > 3(x + 6)$

Q7. Solve the inequality $x^2 - 3x - 10 < 0$
Give the answer using set notation.

Q8. Solve the inequality $x^2 + 8x + 15 > 0$

Q9. Solve the inequality $6x^2 - 19x + 10 < 0$
Give the answer using set notation.

Q10. Solve the inequality $8x^2 + 34x + 21 > 0$
Give the answer using set notation.

Topics listed in objectives

- Solve quadratic inequalities in one variable, by factorising and sketching the graph to find critical values;
- Represent the solution set for inequalities using set notation, i.e. curly brackets and 'is an element of' notation;
  - for problems identifying the solutions to two different inequalities, show this as the intersection of the two solution sets, i.e. solution of $x^2 - 3x - 10 < 0$ as $\{x: -2 < x < 5\}$;
- Solve linear inequalities in two variables graphically;
- Show the solution set of several inequalities in two variables on a graph;

Answers

Q1. (4, 3), (4, 4), (4, 5), (5, 4)

Q2. graph with correct region R shaded

Q3. (0, 4)

Q4. $x = -2, -1, 0, 1$

Q5. $x > 4, x < -1$

Q6. $x > 6, x < -3$

Q7. $\{x: -2 < x < 5\}$

Q8. $x > -3, x < -5$

Q9. $\{x: \frac{2}{3} < x < \frac{5}{2}\}$

Q10. $x : x < \frac{7}{2}$ $x : x > \frac{3}{4}$