PEARSON

Mathematics

STUDENT BOOK | 3RD EDITION

10

AUSTRALIAN CURRICULUM

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COVER **Shutterstock**: Andreichyn, Yurii, geometric pattern; Empics, graphs; Joingate, Fibonacci pattern; Kseniya, Abramova, horse.

TOPIC

4

Linear inequalities

Why learn this?

Understanding how linear inequalities and their associated regions in the plane are represented is fundamental for several reasons:

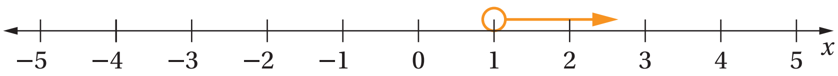
- It forms the basis for visualising and solving linear inequalities, which are common in algebra and essential for calculus.
- Graphing regions helps with understanding the relationship between variables and their constraints within a given system. This is important in fields such as economics, physics and engineering, where more than one solution may exist and it is necessary to identify the optimal one.

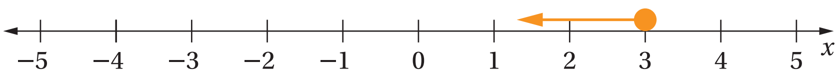
Graphing regions helps to visualise the possible and impossible solutions to mathematical problems. This supports analytical thinking and decision-making in academic and professional settings.

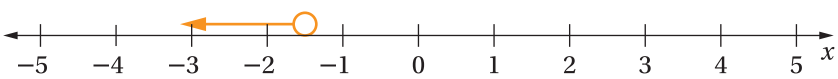
RECALL

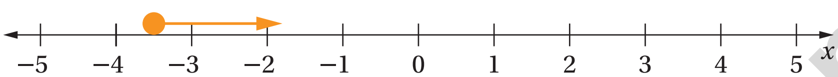
I can interpret inequalities displayed on a number line

1 Write the inequality represented by each of the following.

(a) 

(b) 

(c) 

(d) 

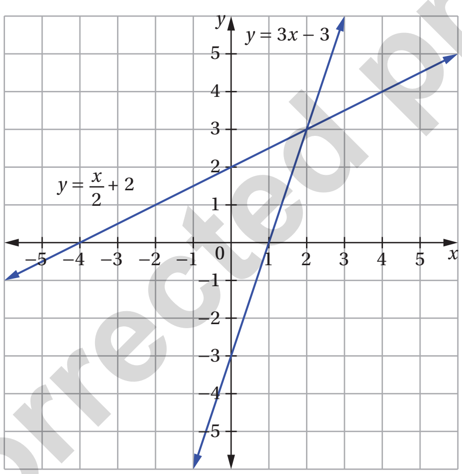
I can graph linear equations

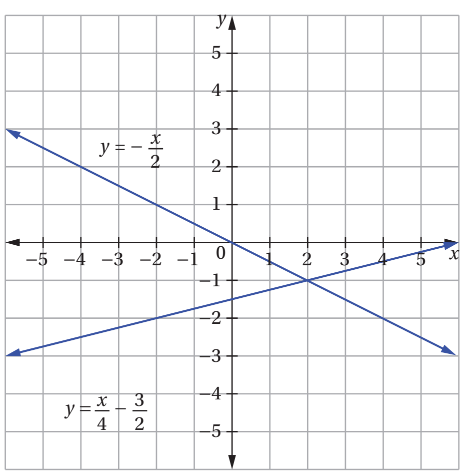
1 Graph each of the following linear equations on the same Cartesian number plane.

(a) $y = x - 4$ **(b)** $y = -2x + 1$ **(c)** $2y = x + 4$ **(d)** $3x - y = 3$

I can identify the mutual solution of two linear equations graphically

1 Identify the coordinates of the mutual solution for each pair of graphed linear equations.

(a) 

(b) 

I can solve simultaneous linear equations algebraically

1 Solve the following pairs of simultaneous linear equations.

(a) $x + y = 4$ and $2x - y = 8$ **(b)** $3x - 2y = 5$ and $x - 2y = 3$

(c) $2x - y = 10$ and $2x + 3y = 6$ **(d)** $4x - 3y = 2$ and $4y - 4x = 3$

Graph vertical and horizontal regions in the plane

4.1

Learning intention: To be able to graph vertical and horizontal regions in the plane.

Success criteria:

SC 1 I can graph horizontal and vertical regions with single boundaries.

SC 2 I can graph regions based on a horizontal or vertical interval.

SC 3 I can graph regions with horizontal and vertical boundaries.

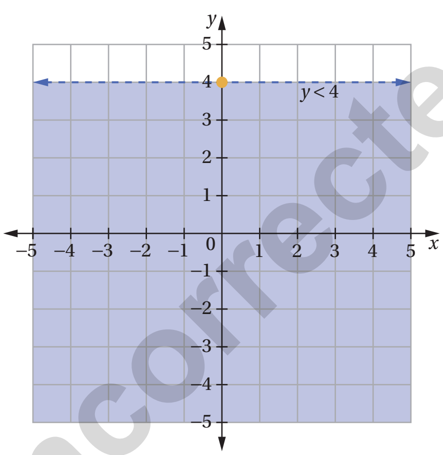
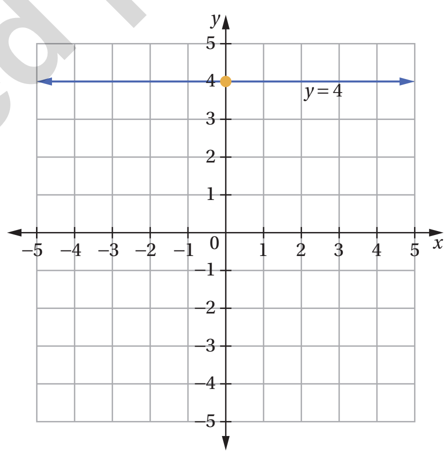
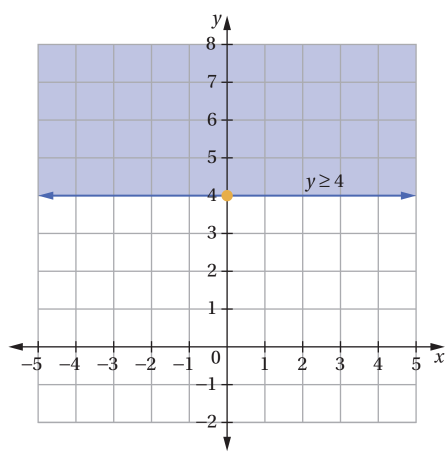
Lesson warm-up

The divider

Practice using the language of less than, equal to and greater than to describe the relationship between everyday classroom objects.

Compare the width, length or weight of two items using statements such as 'is less than', 'is equal to' or 'is greater than.'

SC 1 I can graph horizontal and vertical regions with single boundaries

$y < 4$	$y = 4$	$y \geq 4$
		
A dashed line has been used as the boundary, but it is not included in the region. The region containing points with y-values of less than 4 has been shaded.	A solid line has been used for the graph. No region is shaded, as the points with a y-value of 4 all lie on the line.	A solid line has been used as the boundary and is included in the region. The region containing points with y-values greater than or equal to 4 has been shaded.

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When there is an inequality sign, the graph of the inequality is a shaded region.

A region is shaded when it contains the set of points that satisfies the inequality. Often it is easier to test a point, for example, (0, 0), to determine which side of the boundary to shade. A solid boundary line indicates a line that satisfies the inequality.

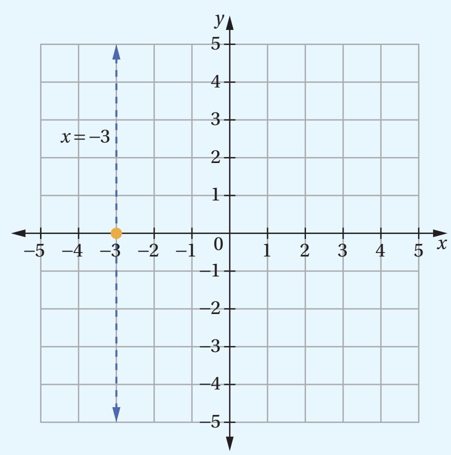
Symbol	Meaning	Type of boundary line
$<$ or $>$	less than or greater than	Dashed line
$\leq$ or $\geq$	less than or equal to or greater than or equal to	Solid line

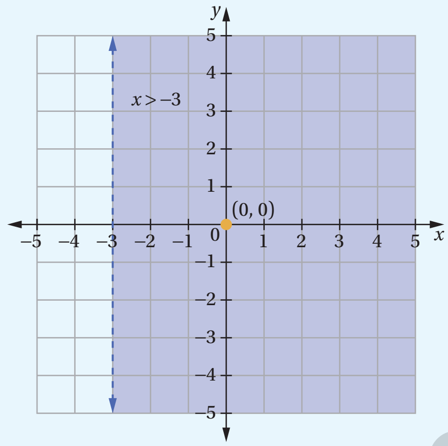
Worked example

Graphing horizontal and vertical regions using the less than and greater than symbols

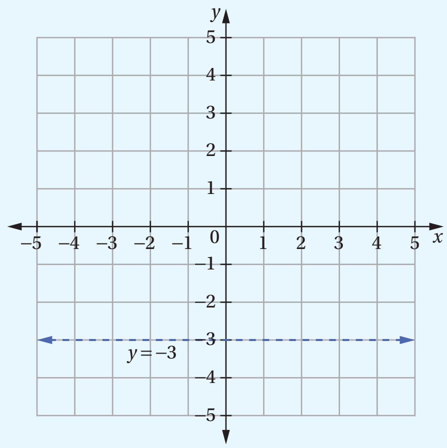
Sketch a graph of the following regions.

(a) $x > -3$

THINKING	WORKING
Determine whether the boundary line will be solid or dashed.	The inequality sign is greater than (>), so the boundary line is dashed, meaning it is not included in the region.
Sketch the boundary line.	The boundary line is $x = -3$. 
Recall the meaning of the inequality symbol.	$x > -3$ means that the shaded region should cover the x-values that are greater than -3.

Shade and label the region.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	At the origin (0, 0), $x = 0$: $0 > -3$. This is true; therefore, the point satisfies the inequality and lies in the shaded region.

(b) $y < -3$

THINKING	WORKING
Determine whether the boundary line will be solid or dashed.	The inequality sign is less than (<), so the boundary line is dashed, meaning it is not included in the region.
Sketch the boundary line.	The boundary line is $y = -3$. 
Recall the meaning of the inequality symbol.	$y < -3$ means that the shaded region should cover the y-values that are less than −3.

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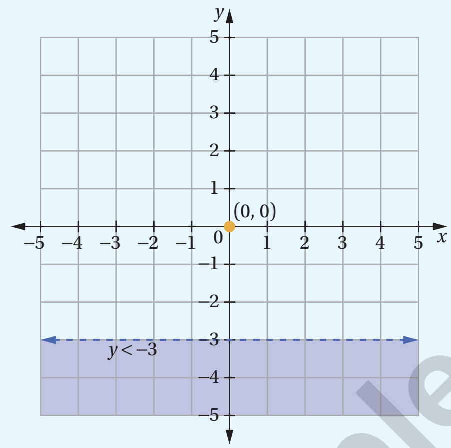
Shade and label the region.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	For the test point (1, −4), $y = -4$ and $-4 < -3$. This is true; therefore, the point satisfies the inequality and lies in the shaded region.

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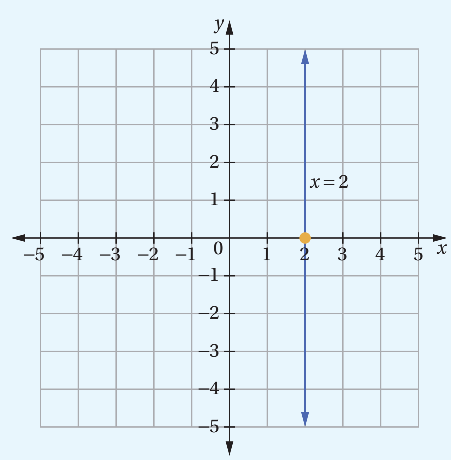
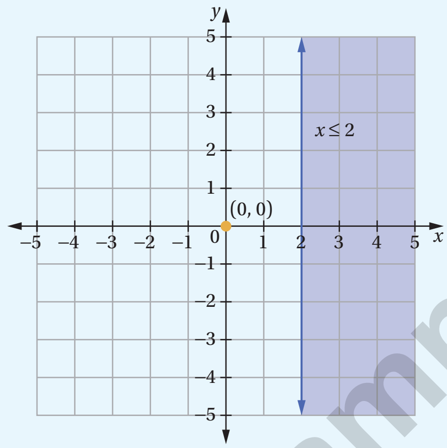
Worked example

Graphing horizontal and vertical regions using the less than or equal to and greater than or equal to symbols

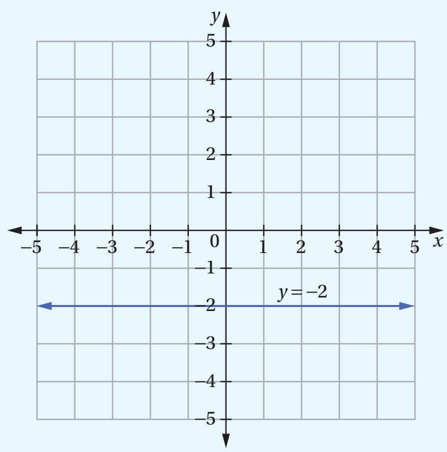
Sketch a graph of each of the following regions.

(a) $x \geq 2$

THINKING	WORKING
Determine whether the boundary line will be solid or dashed.	The inequality sign is greater than or equal to (≥), so the boundary line is solid, meaning it is included in the region.
Sketch the boundary line.	The boundary line is $x = 2$. 

Recall the meaning of the inequality used.	$x \geq 2$ means that the shaded region should cover the x-values that are greater than or equal to 2.
Shade and label the region.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	For the test point (3, 1), $x = 3$ and $3 \geq 2$. This is true; therefore, the point satisfies the inequality and lies in the shaded region.

(b) $y \leq -2$

THINKING	**WORKING**
Determine whether the boundary line will be solid or dashed.	The inequality sign is greater than or equal to (≥), so the boundary line is solid, meaning it is included in the region.
Sketch the boundary line on a graph. Check to see whether the boundary line is included in the region. Does the inequality sign also include 'equal to'?	The boundary line is $y = -2$. The inequality sign is less than or equal to (≤), so the boundary line is solid, meaning it is included in the region. 

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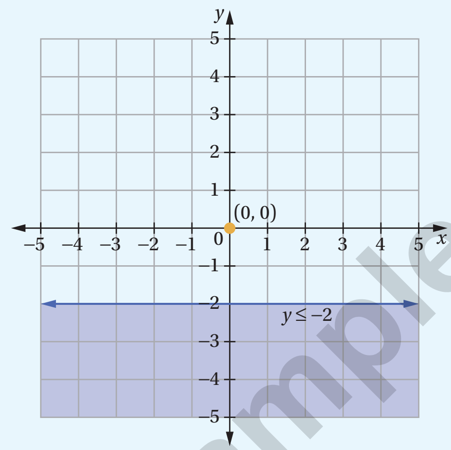
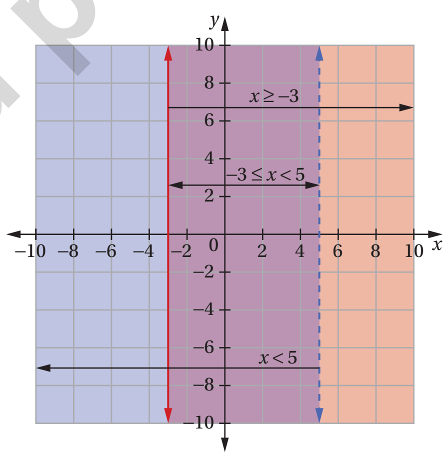
Recall the meaning of the inequality used.	$y \leq -2$ means that the shaded region should cover the y-values that are greater than or equal to -2.
Shade and label the region.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	For the test point $(2, -3)$, $y = -3$ and $-3 \leq -2$. This is true; therefore, the point satisfies the inequality and lies in the shaded region.

SC 2 I can graph regions based on a horizontal or vertical interval

When an interval of values is sketched on the same set of axes, an intersecting region is formed. The set of points inside the intersecting region will be the solution to the inequalities.

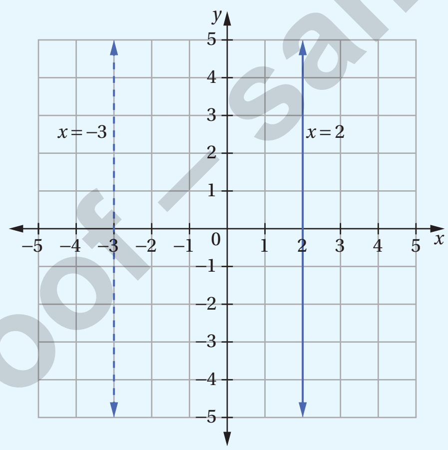
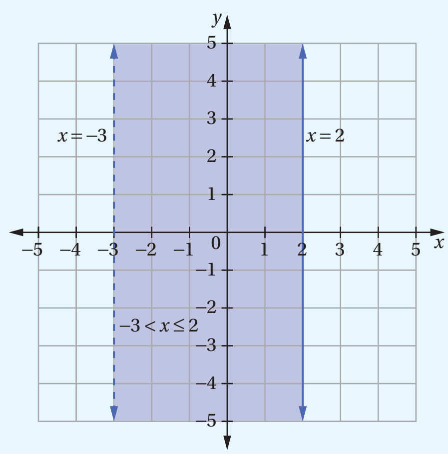


Worked example

Graphing horizontal and vertical intervals

Sketch the following regions on the Cartesian plane.

(a) $-3 < x \leq 2$

THINKING	WORKING
Identify and sketch the boundary lines.	Boundary line 1: $-3 < x$ is the same as $x > -3$. The boundary at $x = -3$ is dashed. Boundary line 2: For $x \leq 2$, the boundary at $x = -2$ is solid. 
Shade the region.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	Substituting $x = 0$ results in $-3 < 0 \leq 2$. This creates a true interval; therefore, the point lies within the interval.

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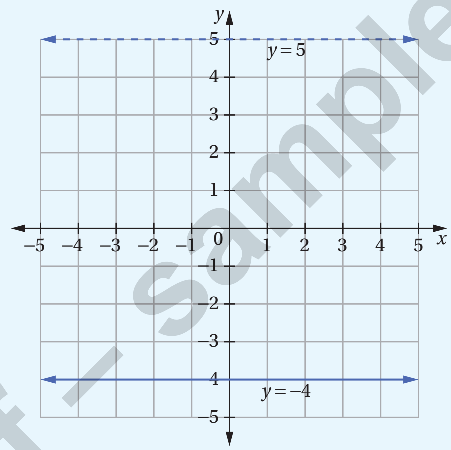
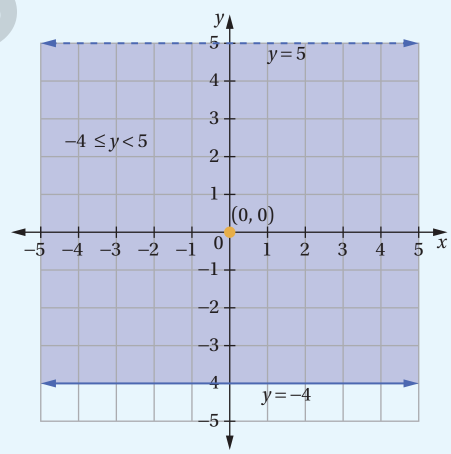
(b) $-4 \leq y < 5$

THINKING	WORKING
Identify and sketch the boundary lines.	Boundary line 1: $-4 \leq y$ is the same as $y \geq -4$. The boundary at $x = -4$ is solid. Boundary line 2: For $y < 5$, the boundary at $y = 5$ is solid. 
Shade the region.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	Substituting $y = 0$ results in $-4 \leq 0 < 5$. This creates a true interval; therefore, the point lies within the interval.

SC 3 I can graph regions with horizontal and vertical boundaries

As the number of inequalities increases, the region that satisfies all of them becomes more restricted.

Worked example

Graphing regions with both horizontal and vertical boundaries

Sketch each of the following on separate sets of Cartesian axes.

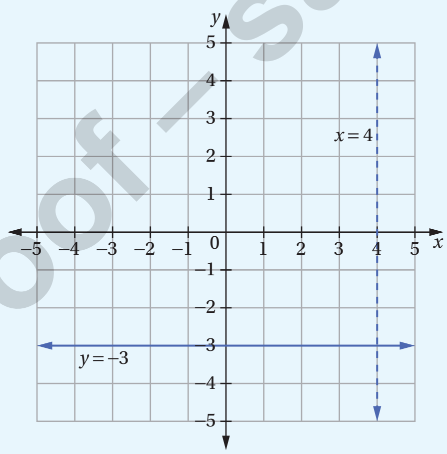
(a) $x < 4$ and $y \geq -3$

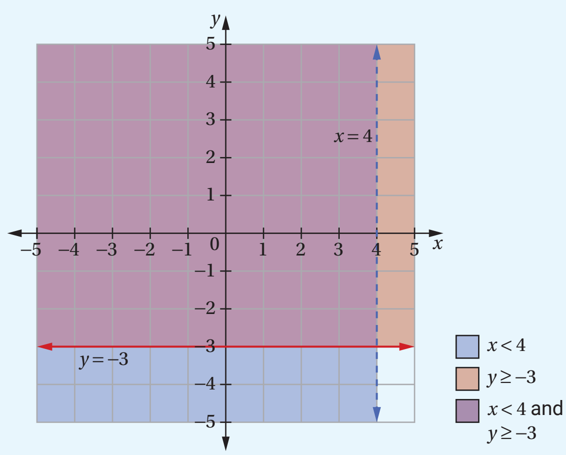
<table>
<tr><th>THINKING</th><th>WORKING</th></tr>
<tr><td>Identify and sketch the boundary lines.</td><td>
Region 1: $x < 4$

The boundary line at $x = 4$ is dashed.

Region 2: $y \geq -3$

The boundary line at $y = -3$ is solid.



</td></tr>
<tr><td>Shade and label each of the regions.</td><td>


</td></tr>
<tr><td>Substitute the x- and y-values of a test point to verify that the shaded region is accurate.</td><td>
For the origin (0, 0), $x = 0$ and $y = 0$ satisfy each inequality.

$0 < 4$ and $0 \geq -3$; therefore, the origin is within the shaded region.
</td></tr>
</table>

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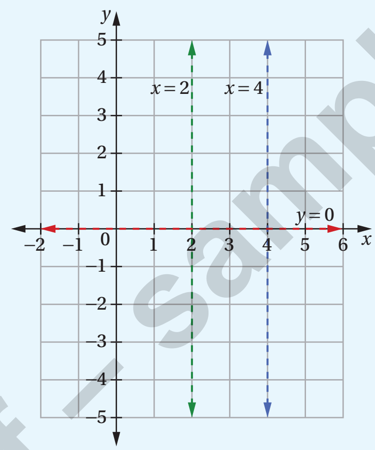
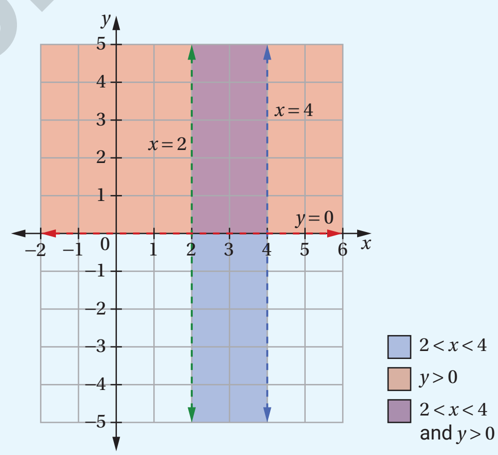
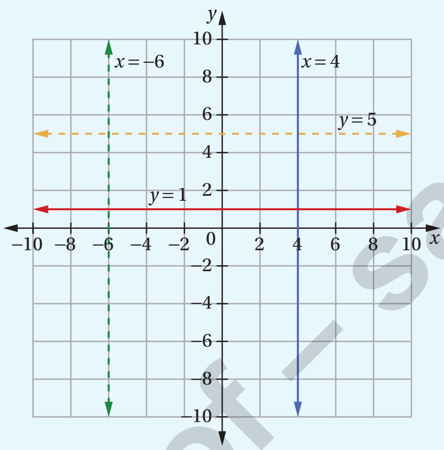
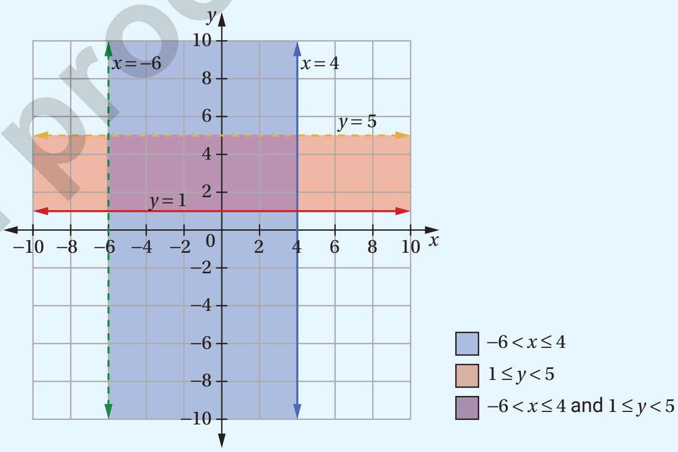
(b) $2 < x < 4$ and $y > 0$

THINKING	WORKING
Identify and sketch the boundary lines.	Boundary line 1: $2 < x < 4$ The boundary lines at $x = 2$ and $x = 4$ are dashed. Region 2: $y > 0$ The boundary line at $y = 0$ is dashed. 
Shade and label each of the regions.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	Regarding the point (3, 1), x: $2 < 3 < 4$ y: $1 > 0$ The point (3, 1) is within the shaded region.

(c) $-6 < x \leq 4$ and $1 \leq y < 5$

THINKING	WORKING
Identify and sketch the boundary lines.	Boundary line 1: $-6 < x \leq 4$ The boundary line at $x = -6$ is dashed, and at $x = 4$ it is solid. Region 2: $1 \leq y < 5$ The boundary line at $y = 1$ is solid, and the line at $y = 5$ is dashed. 
Shade and label each region.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	For the point (0, 3), x: $-6 < 0 \leq 4$ y: $1 \leq 3 < 5$ Both statements are true; therefore, the point satisfies the region bounded by the inequality.

4

Practice

ANSWERS Page XXX

SC 1 I can graph horizontal and vertical regions with single boundaries

1 Sketch each of the following inequalities on a separate graph.

(a) $y > 3$ **(b)** $y < 3$ **(c)** $x < 3$ **(d)** $x > 3$

2 Sketch each of the following inequalities on a separate graph.

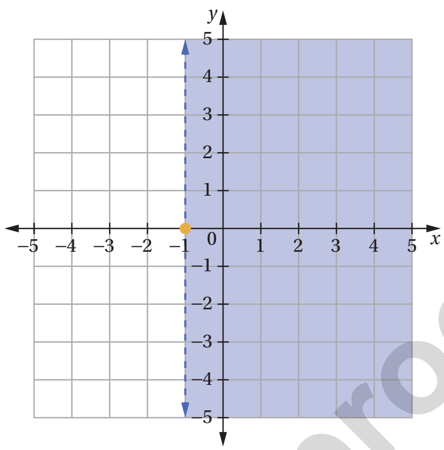
(a) $y \geq -1$ **(b)** $y \leq -1$ **(c)** $x \geq -1$ **(d)** $x \leq -1$

3 Sketch each of the following inequalities on a separate graph.

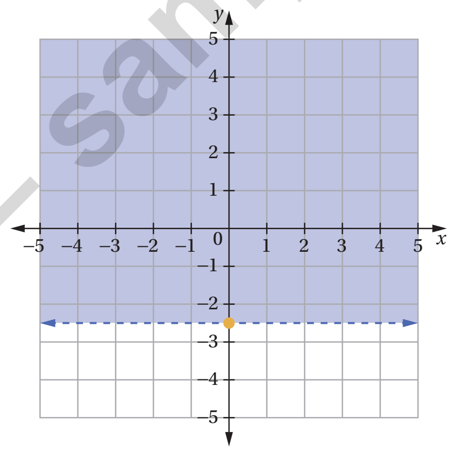
(a) $x \leq \frac{3}{2}$ **(b)** $y > -3.2$

4 Consider the following graphs of inequalities and determine the rule that best represents the inequality shown.

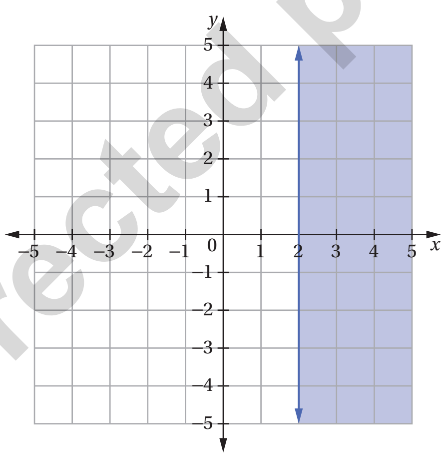
(a)



(b)



(c)



5 List any three pairs of coordinates that satisfy each of the following inequalities.

(a) $-3 \leq x$ **(b)** $y > \frac{5}{3}$ **(c)** $y \geq 4$

SC 2 I can graph regions based on a horizontal or vertical interval

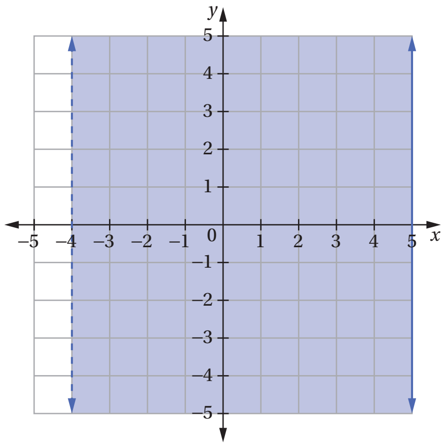
1 Sketch the following inequalities.

(a) $-3 \le x < 5$ **(b)** $-3 < x \le 5$ **(c)** $-3 \le x \le 5$ **(d)** $-3 < x < 5$

2 Sketch the following inequalities.

(a) $-2 < y < 3$ **(b)** $-2 < y \le 3$ **(c)** $-2 \le y < 3$ **(d)** $-2 \le y \le 3$

3 Consider the following graph.



(a) Write the interval shown.

(b) Select the points that belong to the interval from the list: (–4, 0), (2, 10), (–5, 4), (6, 2), (5, –2), (2, –4)

SC 3 I can graph regions with horizontal and vertical boundaries

1 For each of the following, state whether the given point lies in the region specified by the inequalities.

(a) $4 \le x$ and $y < 2$; (5, 0)

(b) $x < 3$ and $0 \le y \le 8$; (3, 0)

(c) $-4 < x \le 6$ and $-1 \le y < 2$; (2, 2)

2 Sketch each of the following on separate sets of Cartesian axes.

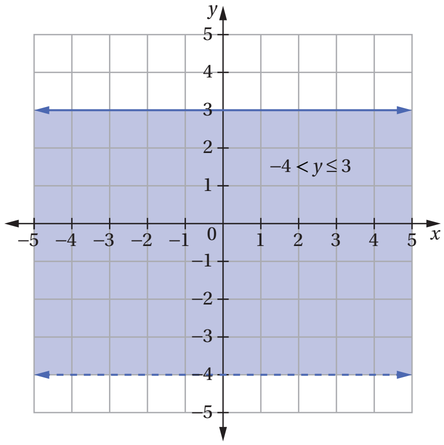
(a) $x \le 5$ and $y < 3$

(b) $x \le 3$ and $-3 < y \le 4$

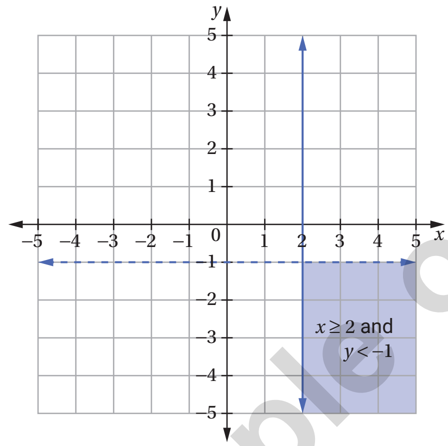
(c) $0 < x \le 5$ and $-5 \le y < 1$

3 Match the graph of each of the following regions with the inequalities that define it.

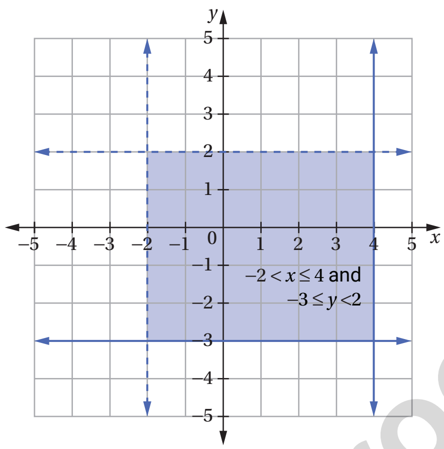
(a)



(b)



(c)



4 Calculate the area of the interior rectangle bounded by the inequalities $-3 \le x \le 2$ and $-3 \le y \le 2$.

Graph and describe linear inequalities with two variables in the plane

4.2

Learning intention: To be able to graph and describe linear inequalities with two variables in the plane.

Success criteria:

SC 1 I can graph linear inequalities with variables on different sides of the inequality symbol.

SC 2 I can graph linear inequalities with variables on the same side of the inequality symbol.

4

Lesson warm-up

Sometimes true, always true or never true?

Decide whether the following statements are sometimes true, always true or never true.

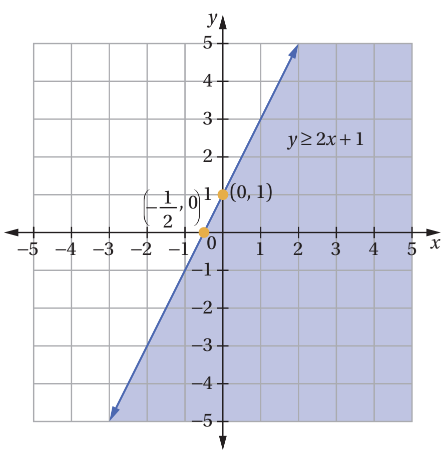
Explain your reasoning.

$-x$ is less than x

x^2 is greater than x

SC 1 I can graph linear inequalities with variables on different sides of the inequality symbol

The inequality $y \geq 2x + 1$ is an example of a linear inequality with variables on either side of the inequality symbol.

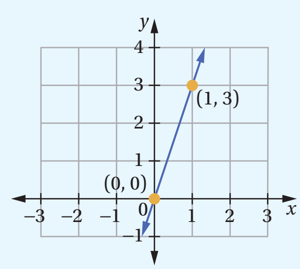
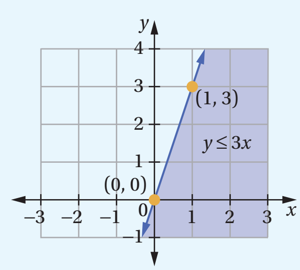


Worked example

Graphing linear inequalities with variables on each side of the inequality symbol

Sketch the graph of each of the following inequalities.

(a) $y \leq 3x$

THINKING	WORKING
Determine the coordinates of the intercepts (or two points) of the straight line boundary.	Boundary line: $y = 3x$ x-intercept, let $y = 0$ $0 = 3x$ $0 = x$ The graph passes through the origin (0, 0). Additional point: Let $x = 1$ $y = 3 \times 1$ $= 3$ The coordinates of an additional point are (1, 3).
Determine whether the boundary line is dashed or solid.	$y \leq 3x$ The boundary line is included because the symbol is 'less than or equal to'; therefore, it is solid.
Plot the points on the Cartesian plane and join with the boundary line.	
Shade and label the region. A region that is 'less than' (<) or 'less than or equal to' (≤) will be shaded below the boundary line. A region that is 'greater than' (>) or 'greater than or equal to' (≥) will be shaded above the boundary line.	

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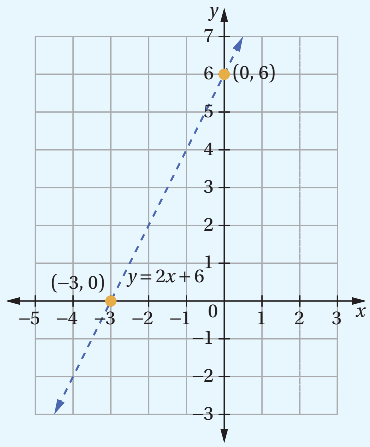
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	Check (1, 2) at $x = 1$ and $y = 2$. $2 \leq 3 \times x$ $2 \leq 3 \times 1$ $2 \leq 3$ The inequality is true; therefore, the point is in the shaded region.

(b) $y > 2x + 6$

THINKING	**WORKING**
Determine the coordinates of the intercepts (or two points) of the straight line boundary. Determine the intercepts for the boundary line. Check to see whether the boundary line is included in the region.	Boundary line: $y = 2x + 6$ x-intercept, let $y = 0$ $0 = 2x + 6$ $-6 = 2x$ $x = -3$ The coordinates of the x-intercept are (−3, 0). y-intercept, let $x = 0$ $y = 2 \times 0 + 6$ $= 6$ The coordinates of the y-intercept are (0, 6). The line will be dotted as the inequality is >; therefore, the boundary line is not included in the region.
Determine whether the boundary line is dashed or solid.	$y > 2x + 6$ The boundary line is not included in the region because the symbol is 'greater than'; therefore, it is dashed.
Plot the points on the Cartesian plane and join with the boundary line.	

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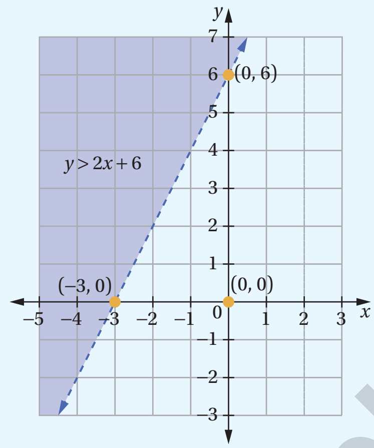
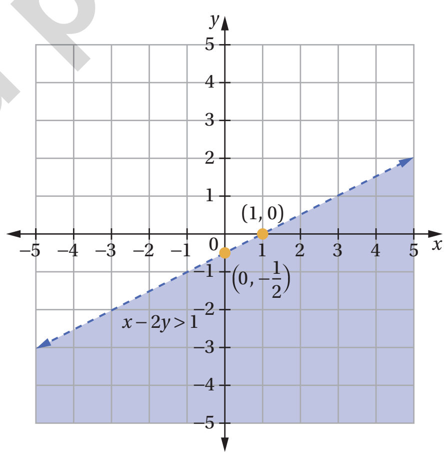
Shade and label the region. A region that is 'less than' < or 'less than or equal to' ≤ will be shaded below the boundary line. A region that is 'greater than' > or 'greater than or equal to' ≥ will be shaded above the boundary line.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	Check (−3, 4) at $x = -3$ and $y = 4$. $y > 2x + 6$ $4 > 2 \times (-3) + 6$ $4 > -6 + 6$ $4 > 0$ The inequality is true; therefore, the point is in the shaded region.

SC 2 I can graph linear inequalities with variables on the same side of the inequality symbol

The inequality $x - 2y > 1$ is an example of a linear inequality that has both variables on the same side of the inequality symbol.

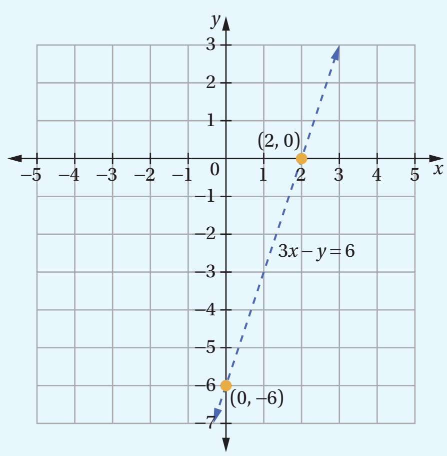


4

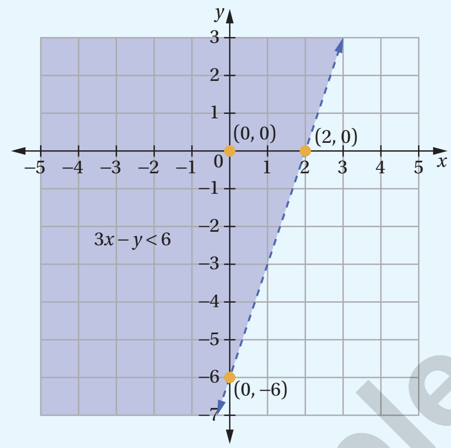
Worked example

Graphing linear inequalities with variables on the same side of the inequality symbol

Sketch the graph of $3x - y < 6$.

THINKING	WORKING
Determine the coordinates of the intercepts (or two points) of the straight line boundary.	Boundary line: $3x - y = 6$ y-intercept, let $x = 0$ $3 \times 0 - y = 6$ $0 - y = 6$ $y = -6$ The coordinates of the y-intercept are (0, –6). x-intercept, let $y = 0$ $3x - 0 = 6$ $3x = 6$ $x = 2$ The coordinates of the x-intercept are (2, 0).
Determine whether the boundary line is dashed or solid.	The boundary line will be dashed, and it is not included in the region because the inequality sign is $<$.
Plot the points on the Cartesian plane and join with the boundary line.	

4

Shade and label the region. A region that is 'less than' (<) or 'less than or equal to' (≤) will be shaded below the boundary line. A region that is 'greater than' (>) or 'greater than or equal to' (≥) will be shaded above the boundary line.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	For (0, 0), $x = 0$ and $y = 0$ $3x - y < 6$ $3(0) - 0 < 6$ $0 < 6$ This is true; therefore, the point satisfies the inequality. The required region is on this side of the boundary line.

Practice

ANSWERS Page XXX

SC 1 I can graph linear inequalities with variables on different sides of the inequality symbol

1 Sketch each of the following inequalities on a separate graph.

(a) $y < x$ **(b)** $y > -x$ **(c)** $y \leq -2x$ **(d)** $y \geq 2x$

2 Sketch each of the following inequalities on a separate graph.

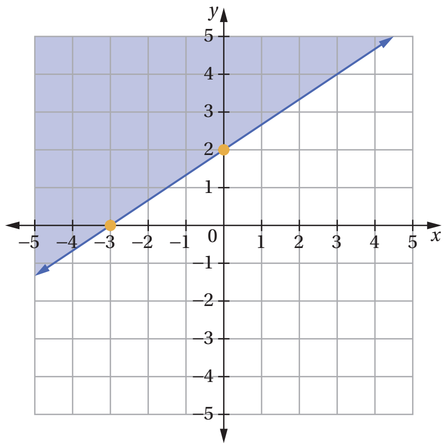
(a) $y > 2x + 1$ **(b)** $y \geq 2x + 1$ **(c)** $y < 2x + 1$ **(d)** $y \leq 2x + 1$

3 Sketch each of the following inequalities on a separate graph.

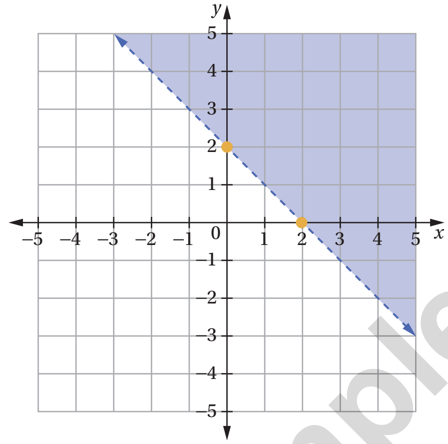
(a) $y > 4x$ **(b)** $4x \geq y$ **(c)** $y \leq \frac{1}{2}x + 2$ **(d)** $y > 6x + 3$

4 Consider the following graphs of inequalities and determine the rule that best represents the inequality shown.

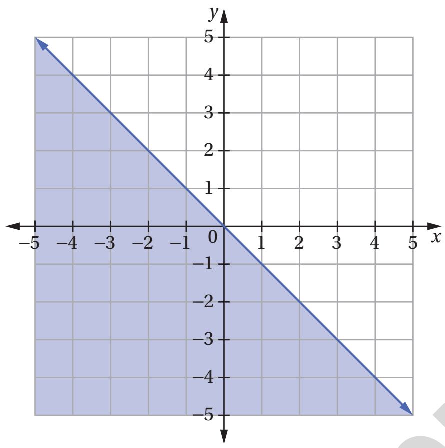
(a)



(b)



(c)



5 For each of the following, state whether the coordinate pair belongs in the area required for the given inequality.

(a) $y \le 4 - x$; (1, –1)

(b) $y > \frac{3(x-2)}{2}$; (–2, –8)

(c) $y \ge \frac{5(-3x+2)}{3}$; (1, –3)

(d) $y < -3\left(\frac{6-2x}{4}\right)$; (3, –2)

SC 2 I can graph linear inequalities with variables on the same side of the inequality symbol

1 Consider the inequality $12x + 2y < 4$.

(a) Determine the coordinates of the y-intercept.

(b) Determine the coordinates of the x-intercept.

(c) Determine whether the boundary line is dashed or solid.

(d) Verify whether (0, 0) is in the shaded region or not.

(e) Graph the inequality.

2 For each of the following inequalities in the form $ax + by = c$, write in gradient-intercept form and then graph the inequality.

(a) $y + 3x < 8$ **(b)** $y + 3x \geq 8$ **(c)** $y - 3x \leq 8$ **(d)** $y - 3x > 8$

3 For each of the following inequalities in the form $ax + by = c$, write in gradient-intercept form and then graph the inequality.

(a) $2y + 6x < 9$ **(b)** $2y + 6x \geq 9$ **(c)** $2y - 6x > 9$ **(d)** $2y - 6x \leq 9$

4 Graph the regions $y > -x$ and $-y > x$. Use your answer to explain how a region specified with a greater than symbol can include shading under the straight line.

5 For each of the following inequalities in the form $ax + by = c$, write in gradient-intercept form and then graph the inequality.

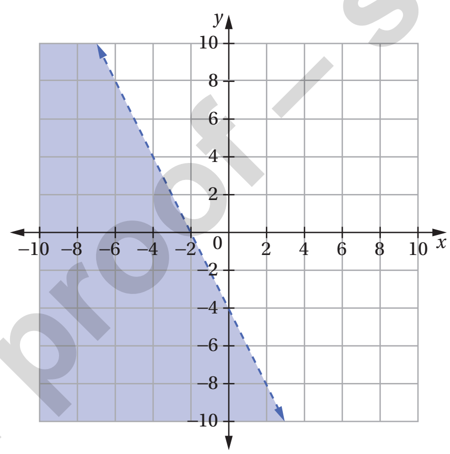
(a) $y - 2x > 1$ **(b)** $2x - y \geq 1$ **(c)** $y - 2x \leq -1$ **(d)** $2x - y < -1$

6 Sketch each of the following regions.

(a) $2y - 3x \geq -16$ **(b)** $y + 2x < -6$

4

7 Consider the following graph.



(a) Write the linear inequality that best describes the above graph.

(b) Using the graph, verify whether (–4, 2) is a solution to the inequality.

(c) Determine the points of two solutions to the inequality.

Graph simultaneous inequalities

4.3

Learning intention: To be able to graph simultaneous inequalities.

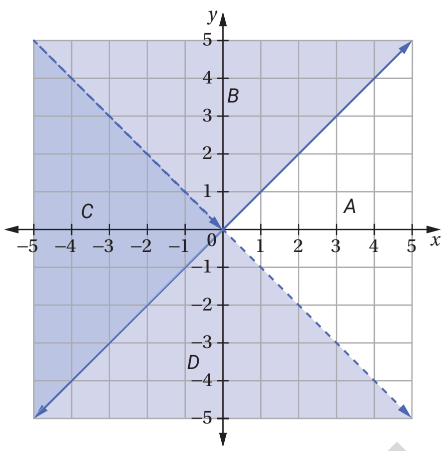
Success criteria:

SC 1 I can graph regions in the Cartesian plane using simultaneous inequalities.

Lesson warm-up

Intersecting regions

Use graphing software to sketch $y \geq x$ and $y < -x$ on the same graph.



Region A is unshaded, which indicates no solution lies within this region.

Region B is shaded once, which indicates this region satisfies one of the inequalities.

Region C is shaded once, which indicates this region satisfies one of the inequalities.

Region D is the overlapping region, which indicates the solution set to both inequalities.

Now, plot each of the following points on the same graph: (0, 1), (1, 0), (0, –1), (–1, 0) and (–3, 1).

What does the overlapping shaded region represent? Explain your reasoning.

SC 1 I can graph regions in the Cartesian plane using simultaneous inequalities

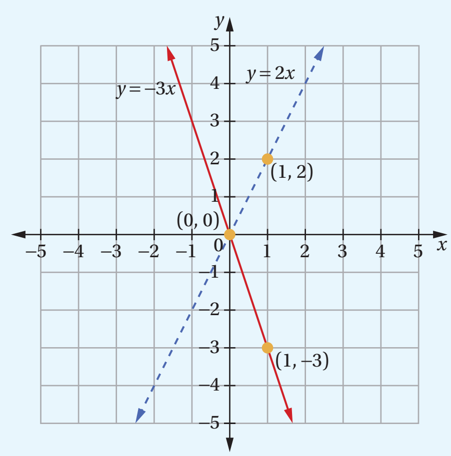
When two linear inequalities are sketched on the same set of axes, and the boundary lines intersect, an intersecting region is formed. The point of intersection of the boundary lines is the solution to the corresponding simultaneous equations. Points within the intersecting region are solutions to the system of linear inequalities. A test point such as (0, 0) can be used to identify or verify the intersection region so long as it is not on one of the boundary lines.

Worked example

Graphing regions using simultaneous inequalities

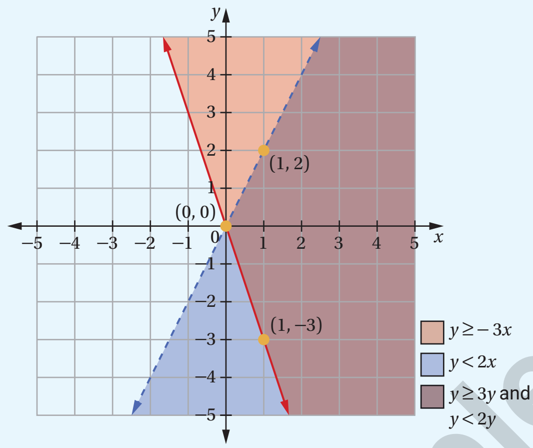
Shade the intersecting region for each of the following pairs of inequalities.

(a) $y \geq -3x$ and $y < 2x$

THINKING	WORKING
Determine the coordinates of the intercepts (or two points) of each of the straight-line boundaries.	Graphs in the form $y = ax$ pass through the origin (0, 0). Boundary line 1: $y = -3x$ At $x = 1$: $y = -3 \times (1)$ $= -3$ The coordinates of another point are (1, −3). Boundary line 2: $y = 2x$ At $x = 1$: $y = 2 \times (1)$ $= 2$ The coordinates of another point are (1, 2).
Determine whether the boundary lines are dashed or solid.	The line $y = -3x$ will be solid because the boundary line is included in the region (≥). The line $y = 2x$ will be dashed since the boundary line is not included in the region (<).
Plot the points on the Cartesian plane and join with the boundary line.	

Shade and label the regions.

A region that is 'less than' (<) or 'less than or equal to' (≤) will be shaded below the boundary line. A region that is 'greater than' (>) or 'greater than or equal to' (≥) will be shaded above the boundary line.



Substitute the x- and y-values of a test point to verify the shaded region is accurate.

The test point is (2, 0).

Substitute the test point into each of the inequalities.

$y \geq -3x$

$0 \geq -3 \times 2$

$0 \geq -6$

$y < 2x$

$0 < 2 \times 2$

$0 < 4$

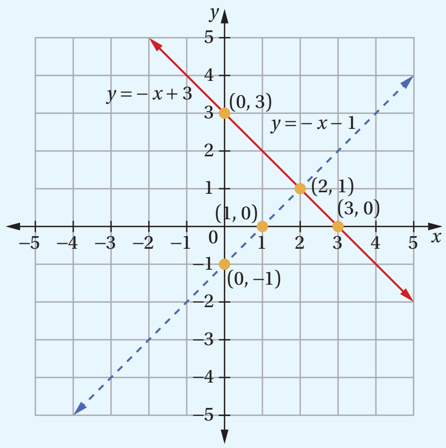
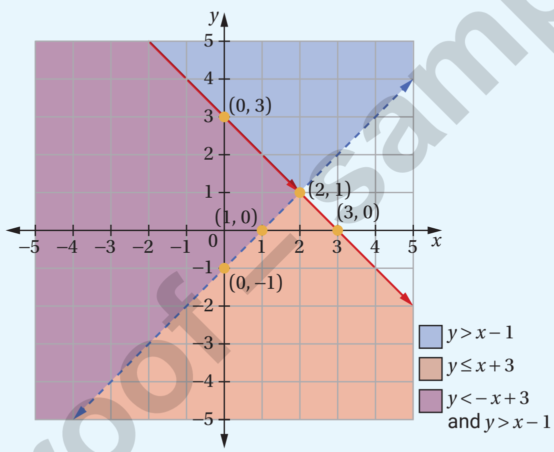
The inequalities are both true; therefore, the point is in the required region.

4

(b) $y \le -x + 3$ and $y > x - 1$

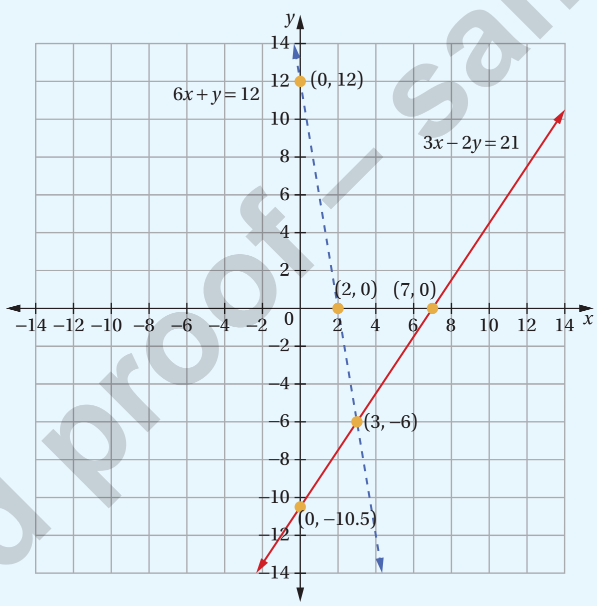
THINKING	WORKING
Determine the coordinates of the intercepts (or two points) of each of the straight-line boundaries.	Boundary line 1: $y = -x + 3$ y-intercept, let $x = 0$: $y = -0 + 3$ $= 0 + 3$ $= 3$ The coordinates of the y-intercept are (0, 3). x-intercept, let $y = 0$: $0 = -x + 3$ $x = 3$ The coordinates of the x-intercept are (3, 0). Boundary line 2: $y = x - 1$ y-intercept, let $x = 0$: $y = 0 - 1$ $= -1$ The coordinates of the y-intercept are (0, –1). x-intercept, let $y = 0$: $0 = x - 1$ $1 = x$ The coordinates of the x-intercept are (1, 0).
Determine whether the boundary lines are dashed or solid.	The boundary line $y = -x + 3$ will be solid because the boundary line is included in the region (≤). The line $y > x - 1$ will be dashed because the boundary line is not included in the region (>).
Determine the coordinates of the point of intersection.	$-x + 3 = x - 1$ $3 = 2x - 1$ $4 = 2x$ $2 = x$ Substitute the value of x into one of the equations of the boundary lines: $y = x - 1$ $= 2 - 1$ $= 1$ The coordinates of the point of intersection are (2, 1).

4

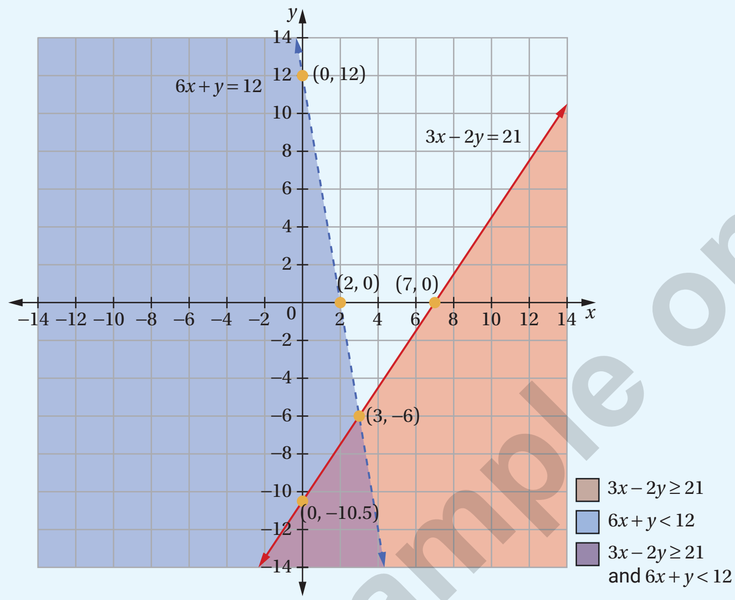
Plot the points on the Cartesian plane and join with the boundary line.	
Shade and label the regions. A region that is 'less than' (<) or 'less than or equal to' (≤) will be shaded below the boundary line. A region that is 'greater than' (>) or 'greater than or equal to' (≥) will be shaded above the boundary line.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	The test point is (0, 0). Substitute the test point into each inequality. $y \le -x + 3$ $0 \le -0 + 3$ $0 \le 3$ $y > x - 1$ $0 > 0 - 1$ $0 > -1$ The inequalities are both true; therefore, the point is in the required region.

(c) $6x + y < 12$ and $3x - 2y \geq 21$

THINKING	WORKING
Determine the coordinates of the intercepts (or two points) of each of the straight-line boundaries.	Boundary line 1: $6x + y = 12$ y-intercept, let $x = 0$:\\ $6 \times 0 + y = 12$ $0 + y = 12$ $y = 12$ The coordinates of the y-intercept are (0, 12). x-intercept, let $y = 0$: $6x + 0 = 12$ $6x = 12$ $x = 2$ The coordinates of the x-intercept are (2, 0). Boundary line 2: $3x - 2y = 21$ y-intercept, let $x = 0$: $3 \times 0 - 2y = 21$ $0 - 2y = 21$ $-2y = 21$ $y = -\frac{21}{2}$ or -10.5 The coordinates of the y-intercept are (0, −10.5). x-intercept, let $y = 0$: $3x - 2 \times 0 = 21$ $3x - 0 = 21$ $3x = 21$ $x = 7$ The coordinates of the x-intercept are (7, 0).
Determine whether the boundary lines are to be dashed or solid.	The boundary line $3x - 2y \geq 21$ will be solid because the boundary line is included in the region ($\geq$). The line $6x + y < 12$ will be dashed because the boundary line is not included in the region ($<$).

Determine the coordinates of the point of intersection.	Solve the simultaneous equations using the method of elimination. $6x + y = 12 \quad [1]$ $3x - 2y = 21 \quad [2]$ $[1] \times 2 \Rightarrow \underline{12x + 2y = 24} \quad [3]$ $[2] + [3] \Rightarrow \quad 5x = 45$ $x = 3$ Substitute $x = 3$ into $6x + y = 12$. $6 \times 3 + y = 12$ $18 + y = 12$ $y = -6$ The coordinates of the point of intersection are (3, −6).
Plot the points on the Cartesian plane and join with the boundary line.	
Write the inequalities in the form $y = mx + c$. Written in this form, the region that is 'less than' (<) or 'less than or equal to' (≤) will be shaded below the boundary line. A region that is 'greater than' (>) or 'greater than or equal to' (≥) will be shaded above the boundary line.	$6x + y < 12$ $y < 12 - 6x$ and $3x - 2y \geq 21$ $3x \geq 21 + 2y$ $3x - 21 \geq 2y$ $2y \leq 3x - 21$ $y \leq \frac{3}{2}x - 10.5$

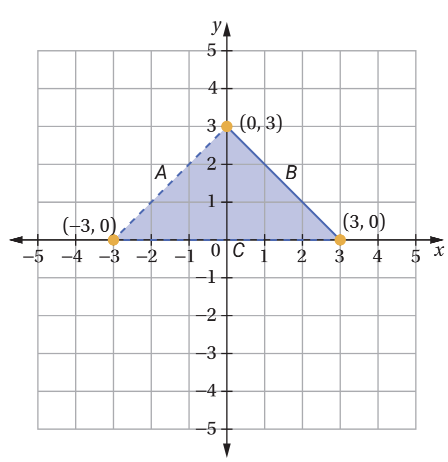
4

Shade and label the regions.	
Substitute the x- and y-values of a test point to verify the shaded region is accurate.	The test point is (2, −14). Substitute the test point into the inequality. $6 \times 2 + (-14) < 12$ $12 - 14 < 12$ $-2 < 12$ $3 \times 2 - 2 \times (-14) \geq 21$ $6 + 28 \geq 21$ $34 \geq 21$ The inequalities are both true; therefore, the point is in the required region.

Worked example

Determining the system of linear inequalities for a region

Consider the shaded region shown below.



(a) Determine the system of linear inequalities that give the above region.

THINKING	WORKING
Identify the number of boundaries.	There are three boundary lines.
Determine the equation of each boundary line.	Boundary line A: $(x_1, y_1) = (-3, 0)$ and $(x_2, y_2) = (0, 3)$ $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-0}{0-(-3)} = \frac{3}{3} = 1$ The y-intercept is (0, 3). The equation of boundary line A is $y = x + 3$. Boundary line B: $(x_1, y_1) = (0, 3)$ and $(x_2, y_2) = (3, 0)$ $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0-3}{3-0} = \frac{-3}{3} = -1$ The coordinates of the y-intercept are (0, 3). The equation of boundary line B is $y = 3 - x$ Boundary line C is given by the horizontal line $y = 0$.
Determine the inequality sign corresponding to each boundary line.	The region lies below boundary line A and the boundary line is dashed, meaning it is not included in the region. The inequality is $y < x + 3$. The region lies below boundary line B and the boundary line is solid, meaning it is included in the region. The inequality is $y \le 3 - x$. The region lies above boundary line C and the boundary line is dashed, meaning it is not included in the region. The inequality is $y > 0$.

4

Substitute the x- and y-values of a test point to verify that the inequalities represent the shaded region.

Regarding $(-1, 1)$, $x = -1$ and $y = 1$.

Region A:

$y < x + 3$

$1 < -1 + 3$

$1 < 2$

Region B:

$y \leq 3 - x$

$1 \leq 3 - (-1)$

$1 \leq 2$

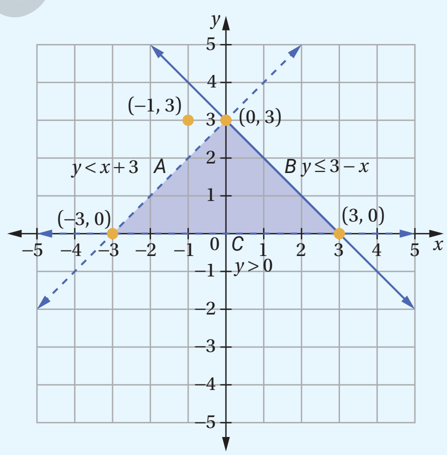
Region C:

$y > 0$

$1 > 0$

The inequalities are all true and could represent a region containing the test point chosen.

(b) Verify that $(-1, 3)$ is not a solution to the system of linear inequalities.

THINKING	WORKING
Demonstrate graphically that the point does not lie within the required region.	 Graphically the point is outside the region.
Demonstrate algebraically that the point does not lie within the one of the regions.	The graph shows that the point is above boundary line A. Regarding $(-1, 3)$, $x = -1$ and $y = 3$. Region A: $y < x + 3$ $3 \not< -1 + 3$ $3 \not< 2$ The point does not satisfy the inequality for region A; therefore, it is not a solution to the system of linear inequalities.

(c) Determine the area of the shaded region.

THINKING	WORKING
Identify the shape and recall the area formula.	The shaded region is a triangle with a base of 6 units and height of 3 units. Formula for the area of a triangle: $A = \frac{b \times h}{2}$
Calculate the area.	When $b = 6$ and $h = 3$: $A = \frac{b \times h}{2}$ $= \frac{6 \times 3}{2}$ $= 9$
Write the answer.	The area of the shaded region is 9 square units.

4

Practice

ANSWERS Page XXX

SC 1 I can graph regions in the Cartesian plane using simultaneous inequalities

1 Sketch each pair of inequalities and state the point of the intersection.

(a) $y > 4x$ and $y \geq -4x$

(b) $y \leq 3x$

(c) $y < 28 - 4x$ and $x + y \leq 13$

(d) $y \geq -2x - 1$ and $y < x + 5$

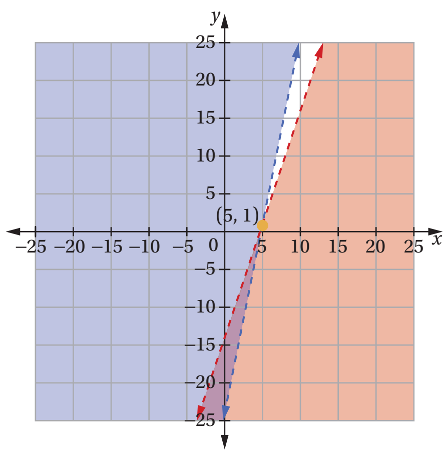
(e) $4x + 3y > 31$ and $2x + 4y < 28$

(f) $x + 2y \geq 6$ and $x - 3y > -12$

2 Consider the following graphs of inequalities:

(a) Determine the system of linear inequalities that would give the above region of intersection.

(b) Demonstrate that $(4, -5)$ is not a solution to the above system of linear inequalities.



3 Sketch $4x + 3y \leq 31$, $x \geq -4$ and $4y + 2x > 28$ onto the same graph.

(a) Determine the coordinates of the points of intersection.

(b) Shade where the three inequalities overlap of intersection.

(c) Calculate the area of the shaded triangle.

4.4 Use linear inequalities to solve real-life problems

Learning intention: To be able to use linear inequalities to solve real-life problems.

Success criteria:

SC 1 I can set up and use linear inequalities to identify all possible solutions for a real-life problem.

Lesson warm-up

Making choices

A chocolate bar costs $8 and a bucket of popcorn costs $12. Each student can spend a maximum of $24.

Investigate:

(a) If students only purchase one type of item, then what is the maximum number of items that could be purchased?

(b) If students purchase both types of items, then list all the possible combinations and determine the maximum number of items that could be purchased.

Rather than listing all possible combinations, how can you solve the problems algebraically or graphically?

SC 1 I can set up and use linear inequalities to identify all possible solutions for a real-life problem

Linear inequalities can be used to graphically represent all possible outcomes in real-life problems and help make choices. Represent a real-life problem using a system of linear inequalities as follows.

- Identify the two variables and any restrictions that might apply.
- Write a linear inequality to represent the problem.
- Sketch the graph.
- Identify all possible solutions.

Worked example

Set up and use linear inequalities to identify all possible solutions for a real-life problem

Identify all the combinations of trips to the cinema ($16) and bowling alley ($20) on a holiday budget of no more than $160. Consider how many trips to each you can purchase.

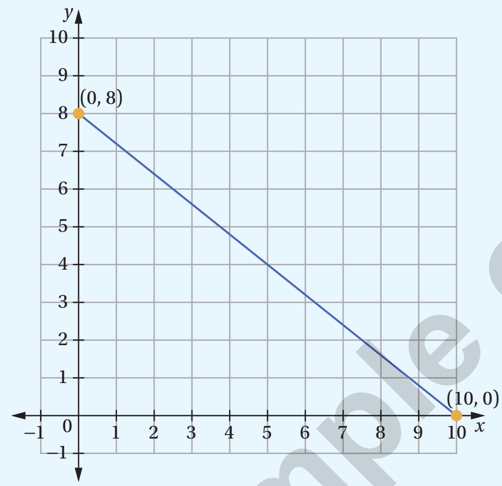
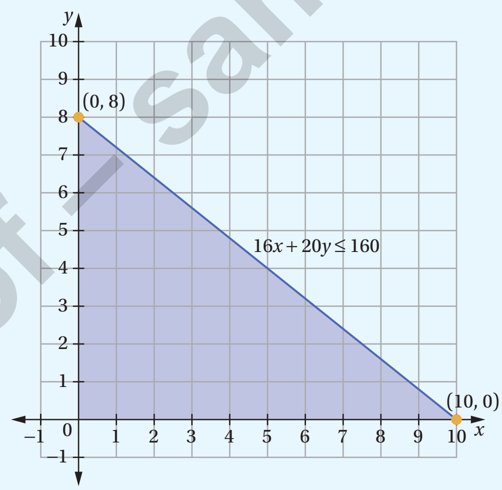
(a) Identify the two variables and any restrictions that might apply.

THINKING	WORKING
Identify the two variables.	Let x be the number of trips to the cinema. Let y be the number of trips to bowling. x and y cannot be negative. $x \geq 0$ $y \geq 0$
Use the variables to write a linear inequality that represents the problem.	The cost of all trips to the cinema and bowling cannot exceed \$160. $16x + 20y \leq 160$

(b) Sketch the graph.

THINKING	WORKING
Determine the coordinates of the intercepts (or two points) of the boundary line.	Boundary line: $16x + 20y = 160$ x-intercept, let $y = 0$: $16x + 20(0) = 160$ $16x = 160$ $x = 10$ The coordinates of the x-intercept are (10, 0). y-intercept, let $x = 0$: $16(0) + 20y = 160$ $20y = 160$ $y = 8$ The coordinates of the y-intercept are (0, 8).
Determine whether the boundary line is to be dashed or solid.	Boundary line: $16x + 20y \leq 160$ The line will be solid because the inequality is $\leq$. Boundary line: $x = 0$ The line will be solid because the inequality is $\geq$. Boundary line: $y = 0$ The line will be solid because the inequality is $\geq$.

4

Plot the points on the Cartesian plane and join with the boundary line(s).	Points are (10, 0) and (0, 8). 
Shade and label the region. A region that is ‘less than’ (<) or ‘less than or equal to’ (≤) will be shaded below the boundary line. A region that is ‘greater than’ (>) or ‘greater than or equal to’ (≥) will be shaded above the boundary line.	
Substitute the x- and y-values of a test point to verify that the shaded region is accurate.	(1, 1) at $x = 1$ and $y = 1$ $16x + 20y \leq 160$ $16(1) + 20(1) \leq 160$ $36 \leq 160$ The inequality is true; therefore, the point is in the shaded region.

(c) List any three possible solutions.

THINKING	WORKING
Possible solutions are all points that are inside the shaded region of the graph. List some possible solutions.	Both x and y are non-negative integers; therefore, some of the possible solutions: (1, 7), (2, 6), (3, 5), (4, 4) (5, 3), (6, 3), (7, 2), (8, 1)
List three of the solutions in context.	2 trips to the cinemas, 6 trips to the bowling alley 6 trips to the cinemas, 3 trips to the bowling alley 4 trips to the cinemas, 4 trips to the bowling alley All three options are possible combinations on a budget of $160 or less.

Practice

ANSWERS Page XXX

4

SC 1 I can set up and use linear inequalities to identify all possible solutions for a real-life problem.

1 Sukh has $10 to spend for lunch. Each muffin costs $5 and each cookie costs $2 at his school café. Consider how many of each he can purchase.

(a) Identify the two variables and any restrictions that might apply.

(b) Write a linear inequality that represents the problem.

(c) Sketch the graph.

(d) List any three possible solutions.

2 Christian is a vet who specialises in fish and hamsters. An appointment for fish usually takes 10 minutes and it takes 15 minutes for a hamster. Christian can work a maximum of 7.5 hours a day.

(a) Identify the two variables and any restrictions that might apply.

(b) Write a linear inequality to represent the problem.

(c) Sketch the graph.

(d) Select the possible solutions from the list (45, –1), (10, 30), (10, 12), (30, 0), $\left(30, \frac{32}{3}\right)$

3 Demitri works as a tutor and is paid $3 per hour. He also works as a baby-sitter and is paid $6 per hour. Because of his study, he cannot work more than 15 hours each week, but he needs to make at least $66 to cover his weekly expenses.

(a) Identify the two variables and any restrictions that might apply.

(b) Write inequalities to represent the problem.

(c) Sketch the graph.

4 Students are required to complete both test A and B for a subject. Students need to achieve at least 19 in test A and at least 32 as the combined result to successfully pass the subject.

(a) Identify two variables and any conditions that might apply.

(b) Write the inequities to represent the problem.

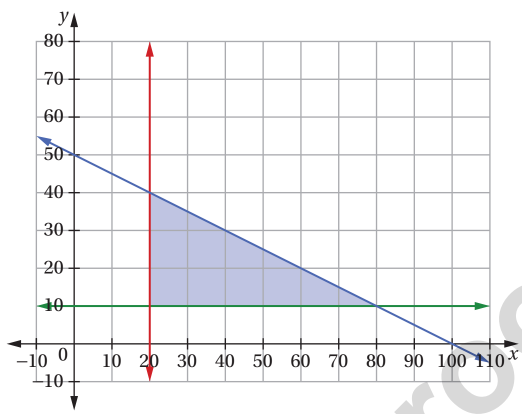
(c) Sketch the graph.

(d) A student achieved 15 in test B. What is the minimum integer result on test A for him to successfully pass this subject?

5 Alexis is planning to sell two handmade crochet items at a local art market: frogs and mini bees. The region below shows information about the number of frogs and the number of mini bees she plans to make in a week.

x = number of frogs she plans to make.

y = number of mini bees she plans to make.



(a) Can Alexis make 40 mini bees and 25 frogs in a week?

(b) Determine the system of inequalities.

(c) The profit for each frog is \$5 and for each mini bee it is \$15. Determine the maximum profit that Alexis can make in that week.

Use inequalities to determine regions involving circles

4.5

Learning intention: To be able to use inequalities to determine regions involving circles.

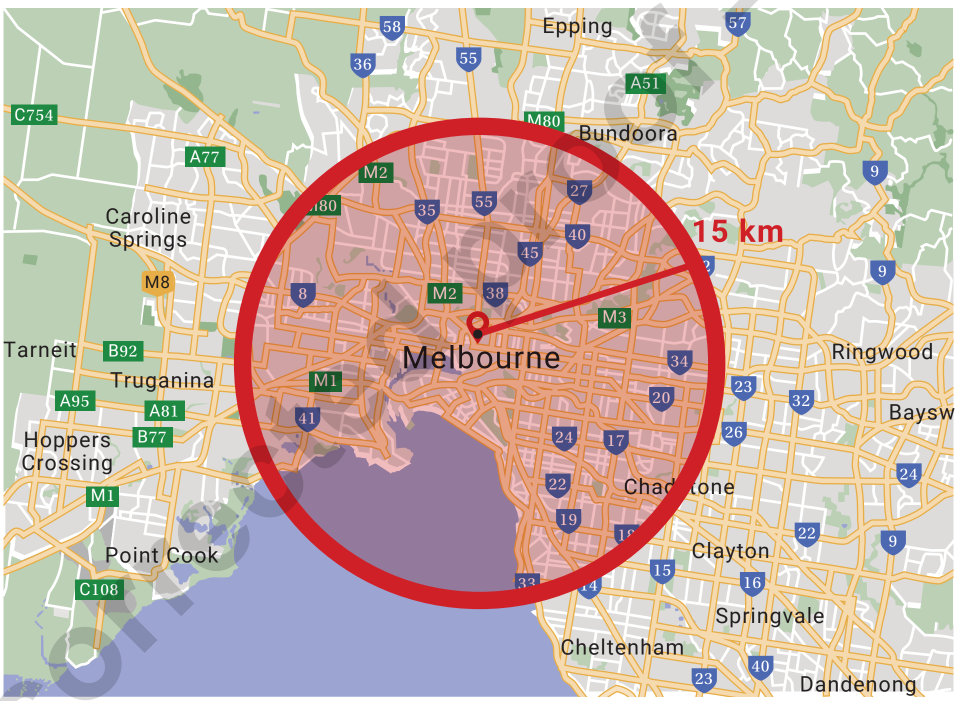
Success criteria:

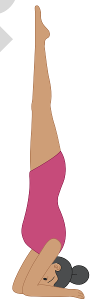
SC 1 I can test whether a given point satisfies an inequality involving a circle.

Lesson warm-up

Location

During the COVID-19 lockdowns, Victorian residents were restricted to travel within a 15 kilometres radius from their home. How can you determine whether a destination is within the 15 kilometres radius, on the exact circle formed by the 15 kilometres radius or farther away from the 15 kilometres radius?
List three locations for each situation using the given graph.

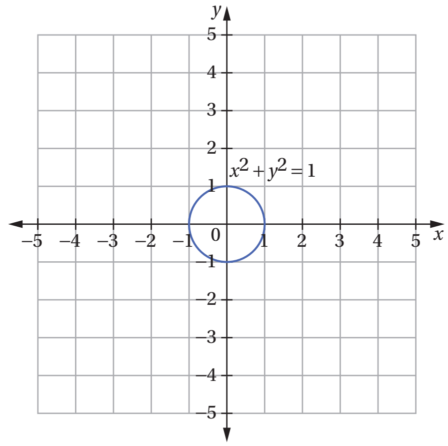




SC 1 I can test whether a given point satisfies an inequality involving a circle

Like linear inequalities, a point can be tested to determine whether it satisfies an inequality involving a circle of a given radius. Substitute the x- and y-values of the point into the inequality to determine which side of the boundary to shade.

The standard equation of a circle is given by $(x - h)^2 + (y - k)^2 = r^2$, in which h and k are the coordinates of the centre and r is a non-zero real number representing the radius of the circle. For example, the unit circle, with centre (0, 0) and a radius of 1 unit, is defined by $x^2 + y^2 = 1$.



The table below outlines the three alternatives when the x- and y-values of a given point are substituted into a circle inequality.

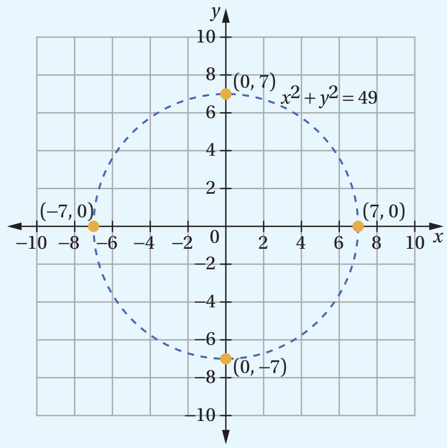
Test inequality	Region of the point
$x^2 + y^2 < r^2$	inside the circle
$x^2 + y^2 = r^2$	on the circle
$x^2 + y^2 > r^2$	outside of the circle

Worked example

Testing whether a given point satisfies an inequality involving a circle

Sketch $x^2 + y^2 > 49$ and determine whether the point (4, 6) lies inside the circle, outside the circle (in the shaded region) or on the circle.

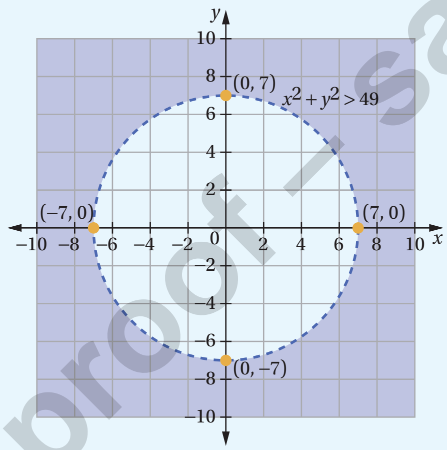
THINKING	WORKING
Determine the coordinates of the intercepts (or two points) of the boundary.	Boundary: $x^2 + y^2 = 49$ x-intercept, let $y = 0$: $x^2 + 0^2 = 49$ $x^2 = 49$ $x = \pm 7$ The coordinates of the x-intercept are (7, 0) and (−7, 0). y-intercept, let $x = 0$: $0^2 + y^2 = 49$ $y^2 = 49$ $y = \pm 7$ The coordinates of the y-intercept are (0, 7) and (0, −7).

<table>
<tr><td>Determine whether the boundary is dashed or solid.</td><td>The curve will be dashed because the inequality is $>$.</td></tr>
<tr><td>Plot the points on the Cartesian plane and join with the boundary curve.</td><td>
</td></tr>
<tr><td>Shade and label the region.

Regarding a circle with radius r:

$x^2 + y^2 < r^2$ is inside the circle,

$x^2 + y^2 = r^2$ is on the circle and

$x^2 + y^2 > r^2$ is outside the circle.</td><td>
</td></tr>
<tr><td>Determine whether the given point (4, 6) lies inside, outside or on the circle.</td><td>The test is point (4, 6).

Graphically, point (4, 6) lies outside the circle, so it satisfies the inequality. Algebraically, substitute the test point into the inequality:

$x^2 + y^2 > 49$

$(4)^2 + (6)^2 > 49$

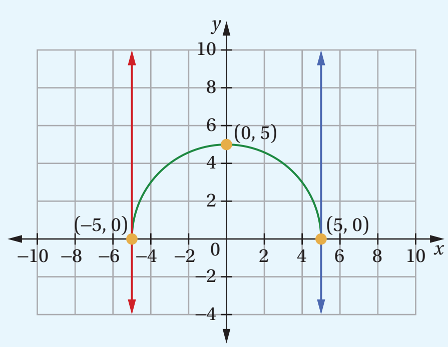
$52 > 49$

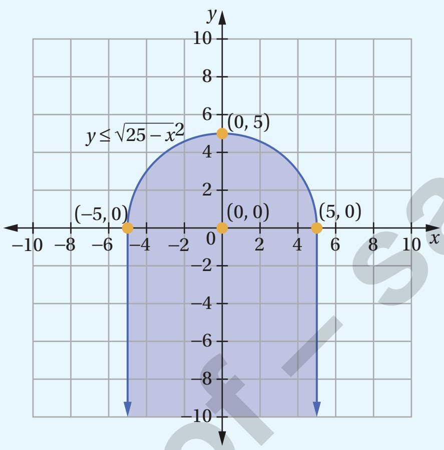
The inequality is true; therefore, the point is outside the circle in the shaded region.</td></tr>
</table>

Worked example

Use inequalities to determine the boundary of a semicircle

Sketch $y \le \sqrt{25 - x^2}$ and determine of the point (3, 5) lies within the shaded region.

THINKING	WORKING
Determine the intercepts for the boundary. Check to see whether the boundary is included in the region.	The graph of $y = \sqrt{25 - x^2}$ is a semicircle, which is part of the boundary. The inequality $y \le \sqrt{25 - x^2}$ is only defined when the square root is applied to a non-negative number; therefore, $25 - x^2 \ge 0$ $x^2 \le 25$ $-5 \le x \le 5$ The vertical lines $x = -5$ and $x = 5$ are boundary lines when $y \le 0$. Let $y = 0$ to determine the x-intercept. Regarding $y = 0$: $0 = \sqrt{25 - x^2}$ $0^2 = 25 - x^2$ $25 = x^2$ $\pm 5 = x$ The coordinates of the x-intercepts are (5, 0) and (–5, 0). Let $x = 0$ to determine the y-intercept. $y = \sqrt{25 - 0^2}$ $y = \sqrt{25}$ $y = 5$ The coordinates of the y-intercept are (0, 5). The curve will be solid because the inequality is $\le$.
Use the points to sketch the boundary on a Cartesian plane.	Points are (5, 0), (0, 5) and (–5, 0) 

Determine which side of the boundary to shade by testing a point that is not on the boundary line.	The test point is (0, 0). Substitute the test point into the inequality: $y \le \sqrt{25 - x^2}$ $0 \le \sqrt{25 - 0^2}$ $0 \le 5$ This is true. 0 is less than or equal to 5, hence the point satisfies the inequality. The required region is on this side of the boundary line.
Shade the region that includes the point that satisfies the inequality. Label the graph and region.	
Test the inequality to determine whether a given point lies inside, outside or on the boundary.	The test point is (3, 5). Graphically, point (3, 5) lies outside the boundary, so it does not satisfy the inequality. Algebraically, substitute the test point into the inequality: $5 \le \sqrt{25 - 3^2}$ $5 \le \sqrt{16}$ $5 \not\le 4$ This is false. 5 is not less than or equal to 4, hence the point does not satisfy the inequality. The given point is on the other side of the boundary line.

Practice

ANSWERS Page XXX

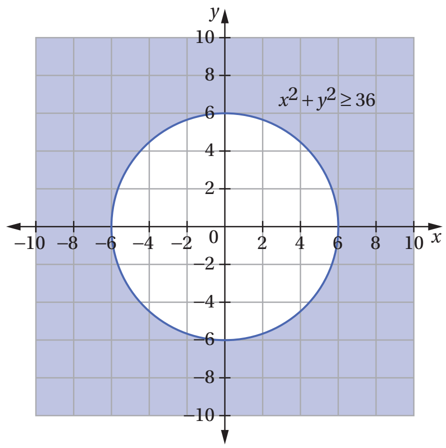
SC 1 I can test whether a given point satisfies an inequality involving a circle

1 Graph the following regions.

(a) $x^2 + y^2 = 4$ **(b)** $x^2 + y^2 \ge 9$ **(c)** $x^2 + y^2 < 16$

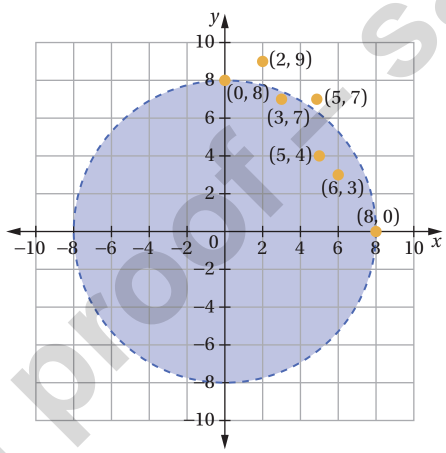
(d) $x^2 + y^2 \le 25$ **(e)** $x^2 + y^2 > 49$

2 Decide whether the following points lie inside the shaded region, outside the shaded region or on the boundary.



(a) (–4, 4) **(b)** (2, 6) **(c)** (0, 6)

3 For the following graph, write the coordinates of 4 points that lie:



(a) on the boundary $x^2 + y^2 = 64$ (note that the boundary is not included in the shaded region)

(b) inside the shaded region $x^2 + y^2 < 64$

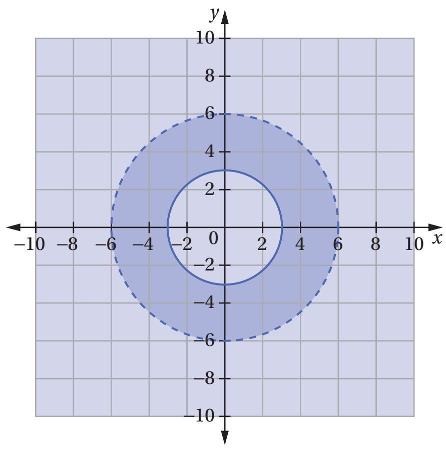
(c) outside the shaded region $x^2 + y^2 > 64$

4 Consider $y > \sqrt{16 - x^2}$.

(a) Sketch the inequality on a Cartesian plane.

(b) Select the points that belong to the inequality from the list: (2, 1), (1, –1), (–1, 5), (5, 1), (0, 4), (–3, 4)

5 Consider the following graph.



(a) Determine the inequalities that best represent the graph shown.

(b) Decide whether the following points lie inside, outside or on the boundary.

(−4, 2), (−2, 1), (−6, 0), (0, 3)

6 Consider $y \geq \sqrt{81 - x^2}$.

(a) State the boundary.

(b) Sketch the inequality.

(c) Decide whether (−3, 5) lies inside, outside or on the boundary.

7 Consider $x^2 + y^2 \leq 16$ and $y > x$.

(a) State the boundaries.

(b) Sketch the inequalities.

(c) State the points of intersection. Give your answer as exact values.

8 Determine whether (3, 4) satisfies the following inequalities.

(a) $y^2 > 64 - x^2$

(b) $y \leq \sqrt{64 - x^2}$

(c) $y^2 < 3x$

(d) $(x - 2)^2 + (y - 2)^2 < 64$

9 Consider $y^2 < 36 - x^2$.

(a) Sketch the inequality.

(b) Select the points that belong to the inequality from the list: (1, −3), (5, −5), (−1, −5), (−7, 3), $\left(4, \frac{7}{3}\right)$

4

Pearson Secondary Teaching Hub – Teaching program
Australian curriculum v9.0
Year level 10

Pearson Secondary Teaching Hub mathematics lessons provide a systematic approach to deliver content in manageable chunks of content, defined by and written specifically to success criteria to ensure learning is relevant and purposeful.

Curriculum coverage

Teaching Hub Year level 10 topics	Strand	AC v9	Content description
Approximation and real numbers	Number	AC9M10N01	recognise the effect of using approximations of real numbers in repeated calculations and compare the results when using exact representations
Algebra (factorisation, expansion, exponents)	Algebra	AC9M10A01	expand, factorise and simplify expressions and solve equations algebraically, applying exponent laws involving products, quotients and powers of variables, and the distributive property
Linear equations in realistic situations	Algebra	AC9M10A02	solve linear inequalities and simultaneous linear equations in 2 variables; interpret solutions graphically and communicate solutions in terms of the situation
Linear inequalities	Algebra	AC9M10A02	solve linear inequalities and simultaneous linear equations in 2 variables; interpret solutions graphically and communicate solutions in terms of the situation
Exponential relations	Algebra	AC9M10A03	recognise the connection between algebraic and graphical representations of exponential relations and solve related exponential equations, using digital tools where appropriate
Algebra and modelling	Algebra	AC9M10A04	use mathematical modelling to solve applied problems involving growth and decay, including financial contexts; formulate problems, choosing to apply linear, quadratic or exponential models; interpret solutions in terms of the situation; evaluate and modify models as necessary and report assumptions, methods and findings
[Activity – coming soon]	*Algebra*	*AC9M10A05*	*experiment with functions and relations using digital tools, making and testing conjectures and generalising emerging patterns*
Surface area, volume	Measurement	AC9M10M01	solve problems involving the surface area and volume of composite objects using appropriate units
Measurement and logarithmic scales	Measurement	AC9M10M02	interpret and use logarithmic scales in applied contexts involving small and large quantities and change
Errors and precision in measurement	Measurement	AC9M10M04	identify the impact of measurement errors on the accuracy of results in practical contexts
Pythagoras, trigonometry, angles and bearings	Measurement	AC9M10M03	solve practical problems applying Pythagoras' theorem and trigonometry of right-angled triangles, including problems involving direction and angles of elevation and depression
Modelling with plans, scale, ratio and proportion	Measurement	AC9M10M05	use mathematical modelling to solve practical problems involving proportion and scaling of objects; formulate problems and interpret solutions in terms of the situation; evaluate and modify models as necessary, and report assumptions, methods and findings
Geometry theorems and proofs	Space	AC9M10SP01	apply deductive reasoning to proofs involving shapes in the plane and use theorems to solve spatial problems
Networks	Space	AC9M10SP02	interpret networks and network diagrams used to represent relationships in practical situations and describe connectedness

[Activity – coming soon]		*AC9M10SP03*	*design, test and refine solutions to spatial problems using algorithms and digital tools; communicate and justify solutions*
Analysing and comparing data representations	Statistics	AC9M10ST01 AC9M10ST02	analyse claims, inferences and conclusions of statistical reports in the media, including ethical considerations and identification of potential sources of bias compare data distributions for continuous numerical variables using appropriate data displays including boxplots; discuss the shapes of these distributions in terms of centre, spread, shape and outliers in the context of the data
Two-variable statistics and data relationships	Statistics	AC9M10ST03 AC9M10ST04	construct scatterplots and comment on the association between the 2 numerical variables in terms of strength, direction and linearity construct two-way tables and discuss possible relationship between categorical variables
[Activity – coming soon]		*AC9M10ST05*	*plan and conduct statistical investigations of situations that involve bivariate data; evaluate and report findings with consideration of limitations of any inferences*
Probability (conditional, dependent & independent)	Probability	AC9M10P01 AC9M10P02	plan and conduct statistical investigations of situations that involve bivariate data; evaluate and report findings with consideration of limitations of any inferences use the language of "if .... then", "given", "of", "knowing that" to describe and interpret situations involving conditional probability
[Activity – coming soon]		*AC9M10P02*	*design and conduct repeated chance experiments and simulations using digital tools to model conditional probability and interpret results*

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Year planner

Term	Pearson Secondary Teaching Hub topics
Term 1	Approximation and real numbers Algebra (factorisation, expansion, exponents) Linear equations in realistic situations Linear inequalities
Term 2	Exponential relations Algebra and modelling Surface area, volume Measurement and logarithmic scales
Term 3	Errors and precision in measurement Pythagoras, trigonometry, angles and bearings Modelling with plans, scale, ratio and proportion Geometry theorems and proofs
Term 4	Networks Analysing and comparing data representations Two-variable statistics and data relationships Probability (conditional, dependent & independent)

Features and support

Phase: Activate prior knowledge

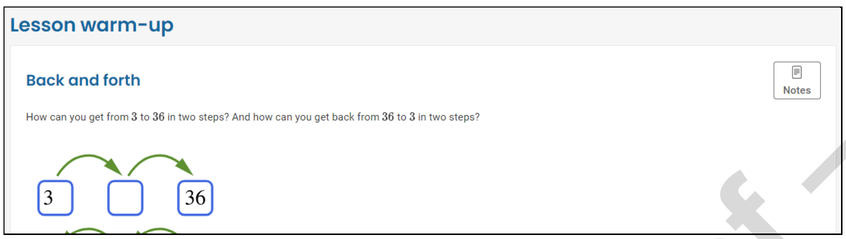
Pearson Diagnostic

These quizzes are mapped to each topic and are designed to diagnose misconceptions and levels of understanding. Based on the results of these quizzes, each student receives personalised targeted activities to overcome misconceptions and upskill to ensure they are working at level for longer.

Lesson warm-up

Every lesson begins with a lesson warm-up. This activity is designed to engage students in the lesson content and activate prior knowledge.

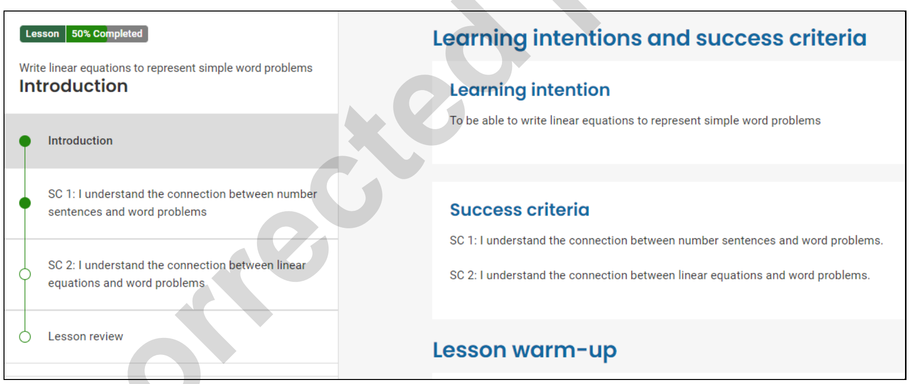
Every lesson warm-up comes complete with Teaching Notes (teacher view only), where teachers are supported with a suggested timeframe, any materials required, enabling and extending prompts and sample solutions.



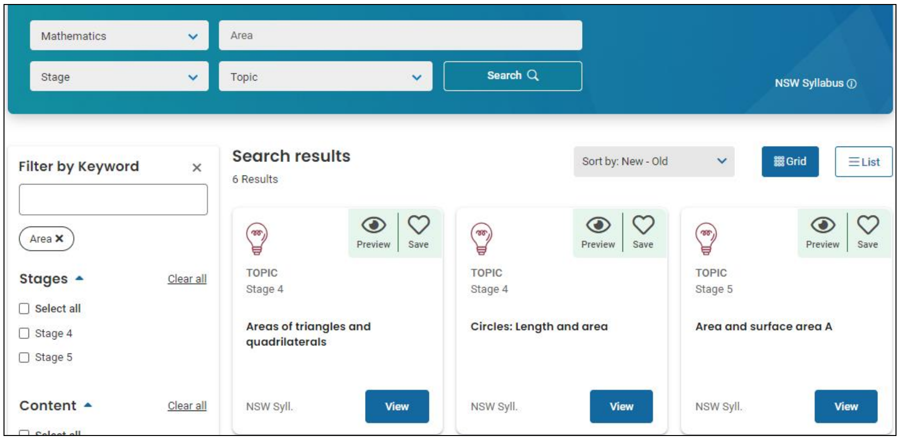
Phase: Setting Learning Goals

The resources in Pearson Secondary Teaching Hub have been specifically created to support teachers and students.

The topics comprise lessons, the purpose of each lesson is defined by a learning intention and success criteria.



The hub gives access to Years 7 – 10 (Australian and Victorian curricula) and Stages 4 and 5 (NSW syllabus) content to ensure all students can access content at a suitable entry point and can be extended.

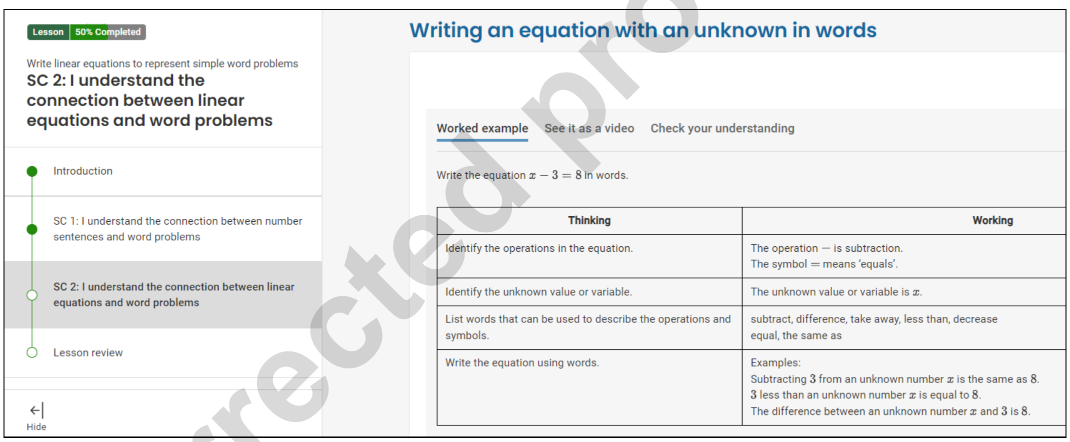


Phase: Presentation (I do)

The demonstration phase of learning is supported with worked examples in the digital platform that are also presented as a video demonstration.

Success criteria have at least one worked example which is further supported with:

- a video walkthrough 'See it as a video'
- a try yourself example in the Student Companion
- 1-3 autocorrecting 'Check your understanding' questions to assess student readiness to progress from guided practice to independent practice.



Phase: Guided Practice (We do)

Each of the digital lessons, contains approximately 1-2 corresponding pages in the Student Companion providing a place for guided practice. The 'try yourself' format of the worked example gives students the opportunity to practice the required skill or skills with the support of their teacher.

Equations

Write linear equations to represent simple word problems

Learning intention: To be able to write linear equations to represent simple word problems

Success criteria:

☐ SC 1: I understand the connection between number sentences and word problems.
☐ SC 2: I understand the connection between linear equations and word problems.

SC 1: I understand the connection between number sentences and word problems

Worked example: Writing a number sentence using words

Write $10-4=6$ as a sentence using words.

Thinking	Working
Identify the operations or symbols used.	
List words that can be used to describe the operations and symbols.	
Write the sentence using words.	

1 Write each number sentence using words.

(a) $11+7=18$ ________

(b) $18-7=11$ ________

(c) $2\times9=18$ ________

(d) $18\div2=9$ ________

2 Write a list of words or phrases that can describe each operation or symbol.

+	−	×	÷	=
add sum				

Phase: Independent Practice (You do)

Independent practice is supported in the digital lesson.

Each success criteria contains a 'Practice' section with approximately 4–6 exercise questions available in both the Student Book and in Hub.

Practice

Complete the following exercise questions in your notebook.

1 Write each equation using words.

(a) $x+3=12$
(b) $x-3=12$
(c) $3x=12$
(d) $\frac{x}{3}=12$

Answer

2 The equations $3x+2=12$ and $3(x+2)=12$ have the same numbers and operations. Will the value of x be the same in both equations? Explain.

Answer

3 Decide whether each pair of expressions are always equal, never equal or sometimes equal. Justify your answer with calculations.

(a) $m+3$ and $3+m$
(b) $t-3$ and $3-t$
(c) $3\times p$ and $p\times3$
(d) $d\div3$ and $3\div d$

Answer

4 Write the following using only numerals and mathematical symbols.

(a) Multiply an unknown number n by 2 to give the answer 11.
(b) Add 7 to a number to give the answer 11.

COMING SOON
The teaching program will supply sample student navigation to support differentiation with a layered curriculum.

Foundation	Standard	Extension

Sample scope and sequence

TERM 1

TERM 1: Weeks 1–2

TOPIC 1: APPROXIMATIONS AND REAL NUMBERS

Content description: AC9M10N01: recognise the effect of using approximations of real numbers in repeated calculations and compare the results when using exact representations

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

☐ <coming soon> ☐

Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Create approximate representation of irrational numbers	**Learning intention:** To be able to create approximate representation of irrational numbers **Success criteria:** SC 1: I can recall the difference between rational and irrational numbers. SC 2: I understand that rounding an irrational number results in an approximate representation of that number.		
Round real numbers	**Learning intention:** To be able to round real numbers **Success criteria:** SC 1: I can round irrational numbers to a required number of decimal places. SC 2: I understand that using approximations of real numbers in repeated calculations can lead to loss of accuracy.		

TERM 1: Weeks 3–5

TOPIC 2: ALGEBRA (FACTORISATION, EXPANSION, EXPONENTS)

Content description: AC9M10A01: expand, factorise and simplify expressions and solve equations algebraically, applying exponent laws involving products, quotients and powers of variables, and the distributive property

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

☐ Values for letters

☐ Letters for numbers or objects

Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Simplify, multiply and divide algebraic fractions	**Learning intention:** To be able to simplify, multiply and divide algebraic fractions **Success criteria:** SC 1: I can simplify algebraic fractions containing exponents. SC 2: I can multiply algebraic fractions with variables in the numerator and/or denominator. SC 3: I can divide algebraic fractions with variables in the numerator and/or denominator.		
Add and subtract algebraic fractions	**Learning intention:** To be able to add and subtract algebraic fractions **Success criteria:** SC 1: I can add and subtract algebraic fractions with numerical denominators. SC 2: I can add and subtract algebraic fractions with algebraic denominators.		
Factorise algebraic expressions by taking out a common factor	**Learning intention:** To be able to factorise algebraic expressions by taking out a common factor **Success criteria:** SC 1: I can factorise algebraic expressions, including those involving exponents by determining integer highest common factors (HCF). SC 2: I can factorise algebraic expressions by grouping pairs.		
Expand binomial products and	**Learning intention:** To be able to expand binomial products and factorise monic quadratic		

	factorise monic quadratic expressions	expressions **Success criteria:** SC 1: I can expand expressions including binomial products. SC 2: I can factorise monic quadratic trinomial expressions.			
	Expand and factorise special products	**Learning intention:** To be able to expand and factorise special products **Success criteria:** SC 1: I can expand and factorise perfect squares. SC 2: I can expand and factorise difference of perfects squares.			
	Factorise by completing the square	**Learning intention:** To be able to factorise by completing the square **Success criteria:** SC 1: I can factorise non-monic quadratic expressions by completing the square. SC 2: I can factorise non-monic quadratic expressions by completing the square.			
	Expand, factorise and simplify algebraic expressions	**Learning intention:** To be able to expand, factorise and simplify algebraic expressions **Success criteria:** SC 1: I can expand and simplify a variety of algebraic expressions including binomial products. SC 2: I can factorise algebraic expressions using appropriate strategies such as taking out common factors and grouping. SC 3: I can simplify algebraic fractions using factorization.			

TERM 1: Weeks 6 – 7

TOPIC 3: LINEAR EQUATIONS IN REALISTIC SITUATIONS

Content description: AC9M10A02: solve linear inequalities and simultaneous linear equations in 2 variables; interpret solutions graphically and communicate solutions in terms of the situation

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

☐ <coming soon> ☐

Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Solve linear equations in practical contexts	**Learning intention:** To be able to solve linear equations in practical contexts **Success criteria:** SC 1: I can solve linear equations algebraically. SC 2: I can solve linear equations graphically. SC 3: I can solve linear equations in practical contexts.		
Graph linear relationships	**Learning intention:** To be able to graph linear relationships **Success criteria:** SC 1: I can graph horizontal and vertical linear relations. SC 2: I can plot a linear graph from a table of values. SC 3: I can graph a linear function from intercepts.		
Solve simultaneous equations graphically	**Learning intention:** To be able to solve simultaneous equations graphically **Success criteria:** SC 1: I can solve simultaneous equations graphically. SC 2: I can solve simultaneous equations in practical contexts.		
Solve simultaneous equations algebraically	**Learning intention:** To be able to solve simultaneous equations algebraically **Success criteria:** SC 1: I can solve simultaneous		

		equations using the elimination method. SC 2: I can solve simultaneous equations using the substitution method.			

TERM 1: Weeks 8 – 10

TOPIC 4: LINEAR INEQUALITIES

Content description: AC9M10A02: solve linear inequalities and simultaneous linear equations in 2 variables; interpret solutions graphically and communicate solutions in terms of the situation

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

☐ <coming soon ☐

Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Graph vertical and horizontal regions in the plane	**Learning intention:** To be able to graph vertical and horizontal regions in the plane **Success criteria:** SC 1: I can graph horizontal and vertical regions with single boundaries. SC 2: I can graph regions based on a horizontal or vertical interval SC 3: I can graph regions with horizontal and vertical boundaries.		
Plot and describe linear inequalities with two variables in the plane	**Learning intention:** To be able to plot and describe linear inequalities with two variables in the plane **Success criteria:** SC 1: I can graph linear inequalities with variables on different sides of the inequality sign SC 2: I can graph linear inequalities with variables on the same side of the inequality		
Graph intersecting regions corresponding to linear inequalities	**Learning intention:** To be able to graph intersecting regions corresponding to linear inequalities **Success criteria:** SC 1: I can graph regions in the plane corresponding to a system of inequalities by solving inequalities simultaneously.		
Use linear inequalities to solve practical	**Learning intention:** To be able to Use linear inequalities to solve		

	problems	practical problems **Success criteria:** SC 1: I can set up and use linear inequalities to identify all possible combinations for a real life problem			
	Use inequalities to determine regions involving circles	**Learning intention:** To be able to use inequalities to determine regions involving circles **Success criteria:** SC 1: I can test an inequality to determine if a given point lies inside, outside or on the boundary of a circle with a specified radius			

TERM 2

TERM 2: Weeks 1–3

TOPIC 5: EXPONENTIAL RELATIONS

Content description: AC9M10A03: recognise the connection between algebraic and graphical representations of exponential relations and solve related exponential equations, using digital tools where appropriate

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Recognise when a sequence is exponential and determine the growth factor	**Learning intention:** To be able to recognise when a sequence is exponential and determine the growth factor **Success criteria:** SC 1. I can recognise when a sequence of data is exponential. SC 2. I can determine the growth/decay factor when a sequence is exponential.		
Write sequences in the form y=b^x	**Learning intention:** To be able to write sequences in the form y=b^x **Success criteria:** SC 1. I can generalise an exponential sequence using algebraic terminology. SC 2. I can identify the initial value and growth/decay factor of an exponential sequence.		
Use graphing software to plot and compare exponential growth/decay functions	**Learning intention:** To be able to use graphing software to plot and compare exponential growth/decay functions **Success criteria:** SC 1. I can visualise exponential growth and decay SC 2. I can verbalise and contrast the difference between various growth factors		
Solve exponential equations	**Learning intention:** To be able to solve exponential equations **Success criteria:** SC 1. I can solve exponential equations using graphical methods		

		with the aid of graphing software.			
	Model exponential growth	**Learning intention:** To be able to model exponential growth **Success criteria:** SC 1. I can model the data by developing an exponential equation with the help of technology. SC 2. I can understand the importance of assumptions/limitations of the model/refining the model/testing or verifying the model.			

TERM 2: Weeks 4–5

TOPIC 6: ALGEBRA AND MODELLING

Content description: AC9M10A04: use mathematical modelling to solve applied problems involving growth and decay, including financial contexts; formulate problems, choosing to apply linear, quadratic or exponential models; interpret solutions in terms of the situation; evaluate and modify models as necessary and report assumptions, methods and findings

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Use linear models in practical contexts	**Learning intention:** To be able to use linear models in practical contexts **Success criteria:** SC 1: I can determine the linear equation given a table of values and a graph. SC 2: I can choose linear models to represent real-life applications.		
Use quadratic models in practical contexts	**Learning intention:** To be able to use quadratic models in practical contexts **Success criteria:** SC 1: I can determine the quadratic equation given a table of values and a graph. SC 2: I can choose quadratic models to represent real-life applications.		
Use exponential models in practical contexts	**Learning intention:** To be able to use exponential models in practical contexts **Success criteria:** SC 1: I can determine the exponential equation given a table of values and a graph. SC 2: I can model compound interest using exponential equations.		

TERM 2: Weeks 6 – 8

TOPIC 7: SURFACE AREA AND VOLUME

Content description: AC9M10M01: solve problems involving the surface area and volume of composite objects using appropriate units

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Draw and describe the surface of right prisms and cylinders	**Learning intention:** To be able to draw and describe the surface of right prisms and cylinders **Success criteria:** SC 1: I can draw the nets of right prisms and cylinders. SC 2: I can describe the surface of right prisms and cylinders. SC 3: I can estimate the surface area of objects using of right prisms and cylinders.		
Calculate the surface area of prisms and cylinders	**Learning intention:** To be able to calculate the surface area of prisms and cylinders **Success criteria:** SC 1: I can calculate the surface area of a cylinder. SC 2: I can calculate the surface area of cylinders in exact form. SC 3: I can calculate the surface area of a prism.		
Determine the surface area of composite solids	**Learning intention:** To be able to determine the surface area of composite solids **Success criteria:** SC 1: I can determine the surface area of composite solids formed from prisms. SC 2: I can determine the surface area of composite solids formed from prisms and cylinders.		
Estimate volume and capacity	**Learning intention:** To be able to estimate volume and capacity **Success criteria:** SC 1: I understand the connection between volume and capacity.		

		SC 2: I can describe the cross-sectional area of prisms and cylinders. SC 3: I can estimate volume in practical situations.			
	Determine the volume of composite solids	**Learning intention:** To be able to determine the volume of composite solids **Success criteria:** SC 1: I can calculate the volume of a cylinder. SC 2: I can calculate the volume of a prism. SC 3: I can determine the volume of composite solids formed from prisms and cylinders.			

TERM 2: Weeks 4–5

TOPIC 8: MEASUREMENT AND LOGARITHMIC SCALES

Content description: AC9M10M02: interpret and use logarithmic scales in applied contexts involving small and large quantities and change

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Understand the connection between logarithms and exponentials	**Learning intention:** To understand the connection between logarithms and exponentials **Success criteria:** SC 1: I can write an exponential equation in logarithmic form. SC 2: I can write a logarithmic equation in exponential form. SC 3: I can evaluate a logarithmic expression using my understanding of exponents.		
Interpret and use logarithmic scales	**Learning intention:** To be able to interpret and use logarithmic scales **Success criteria:** SC 1: I understand that a logarithmic scale is calibrated in terms of powers. SC 2: I can interpret graphs that use logarithmic scales. SC 3: I can analyse graphs and data in financial contexts.		
Use logarithmic scales in real-world contexts	**Learning intention:** To be able to use logarithmic scales in real-world contexts **Success criteria:** SC 1: I can interpret the Richter scale. SC 2: I can interpret decibels. SC 3: I can interpret other logarithmic scales.		

TERM 3

TERM 3: Weeks 1–2

TOPIC 9: ERRORS AND PRECISION IN MEASUREMENT

Outcome code: AC9M10A04: identify the impact of measurement errors on the accuracy of results in practical contexts

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Recognise the impact of systematic errors on the accuracy of results	**Learning intention:** To be able to recognise the impact of systematic errors on the accuracy of results **Success criteria:** SC 1:		
Recognize how inaccurate data through error can bias research findings	Learning intention: **To be able to** recognize how inaccurate data through error can bias research findings **Success criteria:** SC 1:		
Determine the impact measurement errors have in practical contexts	**Learning intention:** To be able to determine the impact measurement errors have in practical contexts **Success criteria:** SC 1: I can identify the impact errors in measurement have on area and volume calculations SC 2: I can solve problems containing calculations involving errors in measurement.		
Recognise the impact compounding errors have on financial calculations	**Learning intention:** To be able to recognise the impact compounding errors have on financial calculations **Success criteria:** SC 1: I can recognise the effect		

		rounding and truncating monetary values have on financial calculations			

TERM 3: Weeks 3–5

TOPIC 10: PYTHAGORAS, TRIGONOMETRY, ANGLES AND BEARINGS

Content description: AC9M10M03: solve practical problems applying Pythagoras' theorem and trigonometry of right-angled triangles, including problems involving direction and angles of elevation and depression

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Solve 2D problems using Pythagoras' theorem and trigonometry	**Learning intention:** To be able to solve 2D problems using Pythagoras' theorem and trigonometry **Success criteria:** SC 1: I can use Pythagoras' theorem to determine the length of the hypotenuse and a shorter side. SC 2: I can use trigonometric ratios to determine the length of an unknown side. SC 3: I can choose an appropriate formula to solve 2D problems.		
Draw and solve problems involving angles of elevation and depression	**Learning intention:** To be able to draw and solve problems involving angles of elevation and depression **Success criteria:** SC 1: I can draw and describe scenarios involving angles of elevation and depression. SC 2: I can model and solve problems involving unknown side lengths using angles of elevation and depression. SC 3: I can solve problems involving multiple angles of elevation or depression.		
Draw and describe compass bearings and true bearings	**Learning intention:** To be able to draw and describe compass bearings and true bearings **Success criteria:** SC 1: I can draw and describe compass bearings. SC 2: I can draw and describe true bearings. SC 3: I can convert between compass bearings and true bearings.		

	Solve 2D problems involving navigation	**Learning intention:** To be able to solve 2D problems involving navigation **Success criteria:** SC 1: I can solve 2D navigation problems involving an unknown length. SC 2: I can solve 2D navigation problems involving an unknown angle.			
	Solve 3D problems using Pythagoras' theorem	**Learning intention:** To be able to solve 3D problems using Pythagoras' theorem **Success criteria:** SC 1: I can recognise 2D triangles in 3D objects. SC 2: I can use Pythagoras' theorem to determine unknown side lengths in 3D objects.			
	Solve 3D problems using Pythagoras and trigonometry	**Learning intention:** To be able to solve 3D problems using Pythagoras and trigonometry **Success criteria:** SC 1:			

TERM 3: Weeks 6 – 7

TOPIC 11: MODELLING WITH PLANS, SCALE, RATIO AND PROPORTION

Content description: AC9M10A05: use mathematical modelling to solve practical problems involving proportion and scaling of objects; formulate problems and interpret solutions in terms of the situation; evaluate and modify models as necessary, and report assumptions, methods and findings

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Solve practical problems involving proportion	**Learning intention:** To be able to solve practical problems involving proportion **Success criteria:** SC 1: I can use proportion to find amounts. SC 2: I can divide n amount in a given proportion. SC 3: I can change an amount in a given proportion.		
Use scale factor to identify corresponding lengths in an original object and its scale model	**Learning intention:** To be able to use scale factor to identify corresponding lengths in an original object and its scale model **Success criteria:** SC 1: I can calculate lengths where the scale model is a reduction. SC 2: I can calculate lengths where the scale model is an enlargement.		
Solve problems involving square scaling of area and surface area and cube scaling of volume corresponding to scaling of linear dimensions	**Learning intention:** To be able to Solve problems involving square scaling of area and surface area and cube scaling of volume corresponding to scaling of linear dimensions **Success criteria:** SC 1: I can calculate corresponding area from a scale factor. SC 2: I can calculate corresponding volume from a scale factor.		
Use plan and elevation diagrams to	**Learning intention:** To be able to use plan and elevation diagrams to solve problems involving scale and		

	solve problems involving scale and measurement in buildings	measurement in buildings **Success criteria:** SC 1: I can choose an appropriate scale. SC 2: I can convert to actual measurements. SC 3: I can make changes to designs to ensure compliance.			

TERM 3: Weeks 8 – 10

TOPIC 12: GEOMETRIC THEOREMS AND PROOFS

Content description: AC9M10SP01: apply deductive reasoning to proofs involving shapes in the plane and use theorems to solve spatial problems

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Understand and use the conditions for congruent and similar triangles	**Learning intention:** To be able to understand and use the conditions for congruent and similar triangles **Success criteria:** SC 1: I can list and use the conditions for similarity in triangles. SC 2: I can list and use the conditions for congruence in triangles.		
Understand the nature of geometric proof	**Learning intention:** To understand the nature of geometric proof **Success criteria:** SC 1: I can interpret geometric diagrams and use shorthand geometric notation. SC 2: I can distinguish between a practical demonstration and a proof.		
Prove congruence and similarity	**Learning intention:** To be able to prove congruence and similarity **Success criteria:** SC 1: I can develop proofs involving congruent triangles and angle properties. SC 2: I can develop proofs involving similar triangles and angle properties.		
Use geometric properties of special quadrilaterals	**Learning intention:** To be able to use geometric properties of special quadrilaterals **Success criteria:** SC 1: I can name and describe the six special quadrilaterals. SC 2: I can deduce the types of quadrilateral from a description of its features. SC 3: I can classify quadrilaterals		

		according to their diagonals.			
	Apply geometric theorems and proofs	**Learning intention:** To be able to apply geometric theorems and proofs **Success criteria:** SC 1: I ca find missing angles and side lengths in geometric shapes by applying the theorems covered. SC 2: I can apply properties of circles and chords.			
	Use dynamic geometric software to demonstrate proofs	**Learning intention:** To be able to use dynamic geometric software to demonstrate proofs **Success criteria:** SC 1:			

TERM 4

TERM 4: Weeks 1–2

TOPIC 13: NETWORKS

Content description: AC9M10SP02: interpret networks and network diagrams used to represent relationships in practical situations and describe connectedness

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Develop the language of networks	**Learning intention:** To be able to develop the language of networks **Success criteria:** SC 1: I can identify the key components of networks and network diagrams, including connectedness. SC 2: I can classify types of graphs.		
Construct network diagrams	**Learning intention:** To be able to construct network diagrams **Success criteria:** SC 1: SC 1: I can construct network diagrams for simple networks. SC 2: I can construct graphs to represent more complex networks.		
Understand the connection between polyhedra and networks	**Learning intention:** To understand the connection between polyhedra and networks **Success criteria:** SC 1: I can investigate how polyhedra can be represented as a network using edges, vertices, interior and exterior faces SC 2: I can demonstrate how Euler's formula applies to planar graphs.		
Investigate how networks and network diagrams can be used to model	**Learning intention:** To investigate how networks and network diagrams can be used to model authentic situations **Success criteria:**		

	authentic situations	SC 1: I can use network diagrams to investigate practical problems SC 2: I can investigate the use of networks to represent authentic situations			

TERM 4: Weeks 3 – 5

TOPIC 14: ANALYSING AND COMPARING DATA REPRESENTATIONS

Content descriptions

AC9M10ST01: analyse claims, inferences and conclusions of statistical reports in the media, including ethical considerations and identification of potential sources of bias

AC9M10ST02: compare data distributions for continuous numerical variables using appropriate data displays including boxplots; discuss the shapes of these distributions in terms of centre, spread, shape and outliers in the context of the data

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Analyse published data representations	**Learning intention:** To be able to analyse published data representations **Success criteria:** SC 1: I can identify and describe misleading data representations in the media. SC 2: I can identify whether the source and size of sampled data is representative of the population to be analysed.		
Determine quartiles and interquartile range	**Learning intention:** To be able to determine quartiles and interquartile range **Success criteria:** SC 1: I can create a five-number summary of numerical data. SC 2: I can identify quartiles to calculate the interquartile range for a data set. SC 3: I can compare and explain the relative merits of range and interquartile range as measures of spread.		
Create and use box plots to compare numerical datasets	**Learning intention:** To be able to create and use box plots to compare numerical datasets **Success criteria:** SC 1: I can represent data as a box plot using five-number summaries. SC 2: I can compare and contrast the spread and measures of centre for two or more parallel box plots.		

	Create five-number summaries from different data displays	**Learning intention:** To be able to create five-number summaries from different data displays **Success criteria:** SC 1: I can determine quartiles from datasets displayed in histograms, cumulative frequency graphs and dot plots, and represent the data set as a box plot			
	Interpret data displayed in histograms and box plots to draw conclusions and make inferences	**Learning intention:** To be able to interpret data displayed in histograms and box plots to draw conclusions and make inferences **Success criteria:** SC 1: I can identify and describe skewness or symmetry of datasets displayed in histograms, cumulative frequency graphs and dot plots and box plots. SC 2: I can Interpret box plots to draw conclusions and make inferences about the dataset			

TERM 4: Weeks 6 – 8

TOPIC 15: DATA DISTRIBUTIONS FOR CONTINUOUS NUMERICAL DATA

Content descriptions

AC9M10ST03: construct scatterplots and comment on the association between the 2 numerical variables in terms of strength, direction and linearity

AC9M10ST04: construct two-way tables and discuss possible relationship between categorical variables

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Analyse two-variable statistics and data relationships	**Learning intention:** To be able to analyse two-variable statistics and data relationships **Success criteria:** SC 1: I can identify and explain when 1-variable or 2-variable (bivariate) data is required in a dataset SC 2: I can identify and describe the difference between association or casual relationships of variables in bivariate data SC 3: I can identify and describe the cause and effect relationship between independent and dependent variables.		
Draw two-variable scatter plots and line of best fit, by eye	**Learning intention:** To be able to draw two-variable scatter plots and line of best fit, by eye **Success criteria:** SC 1: I can collect and represent numerical bivariate data using a scatterplot. SC 2: I can create a line of best fit, by eye, for bivariate data displayed in a scatterplot and find its equation.		
Interpret data involving 2 numerical variables, using graphical representations	**Learning intention:** To be able to interpret data involving 2 numerical variables, using graphical representations **Success criteria:** SC 1: I can informally describe the strength (strong, moderate or weak), and direction (positive or negative), of the linear relationship between 2 numerical values		

		SC 2: I can use the line of best fit, by eye, to make predictions using interpolation and extrapolation, and identify limitations of such models when making these predictions.			
	Construct two-way tables	**Learning intention:** To be able to construct two-way tables **Success criteria:**			
		SC 1: I can construct two-way tables to study relationships between categorical variables			
		SC 2: I can identify patterns and associations in data presented in a two-way table using percentages and proportions			

TERM 4: Weeks 9 – 10

TOPIC 16: PROBABILITY (CONDITIONAL, DEPENDENT AND INDEPENDENT)

Content descriptions

AC9M10P01: use the language of “if .... then”, “given”, “of”, “knowing that” to describe and interpret situations involving conditional probability

AC9M10P02: design and conduct repeated chance experiments and simulations using digital tools to model conditional probability and interpret results

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Pearson Diagnostic quizzes

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Lesson name	Learning intention and success criteria	Differentiating independent practice	Annotations, other resources, teacher sign off
Solve problems involving conditional probabilities	**Learning intention:** To be able to solve problems involving conditional probabilities **Success criteria:** SC 1: I can use Venn diagrams to display relationships between described events. SC 2: I can use Venn diagrams to describe and interpret situations involving conditional probability. SC 3: I can use two-way tables to describe and interpret situations involving conditional probability.		
Solve problems involving independent and dependent events using arrays and tree diagrams	**Learning intention:** To be able to solve problems involving independent and dependent events using arrays and tree diagrams **Success criteria:** SC 1: I can calculate probability involving independent events. SC 2: I can use an array to distinguish between dependent and independent events. SC 3: I can use tree diagrams to compare probabilities of dependent and independent events.		
Design and conduct a probability investigation	**Learning intention:** To be able to design and conduct a probability investigation **Success criteria:** SC 1: I can explain the importance of sample sizes and the effect of		

		replacement when using samples to make predictions for a population. SC 2: I can design and use simulations to gather data on frequencies and make predictions for situations involving chance, including modelling real-life scenarios. SC 3: I can design and conduct repeated chance experiments and simulations using digital tools to model conditional probabilities, and interpret results.			

References