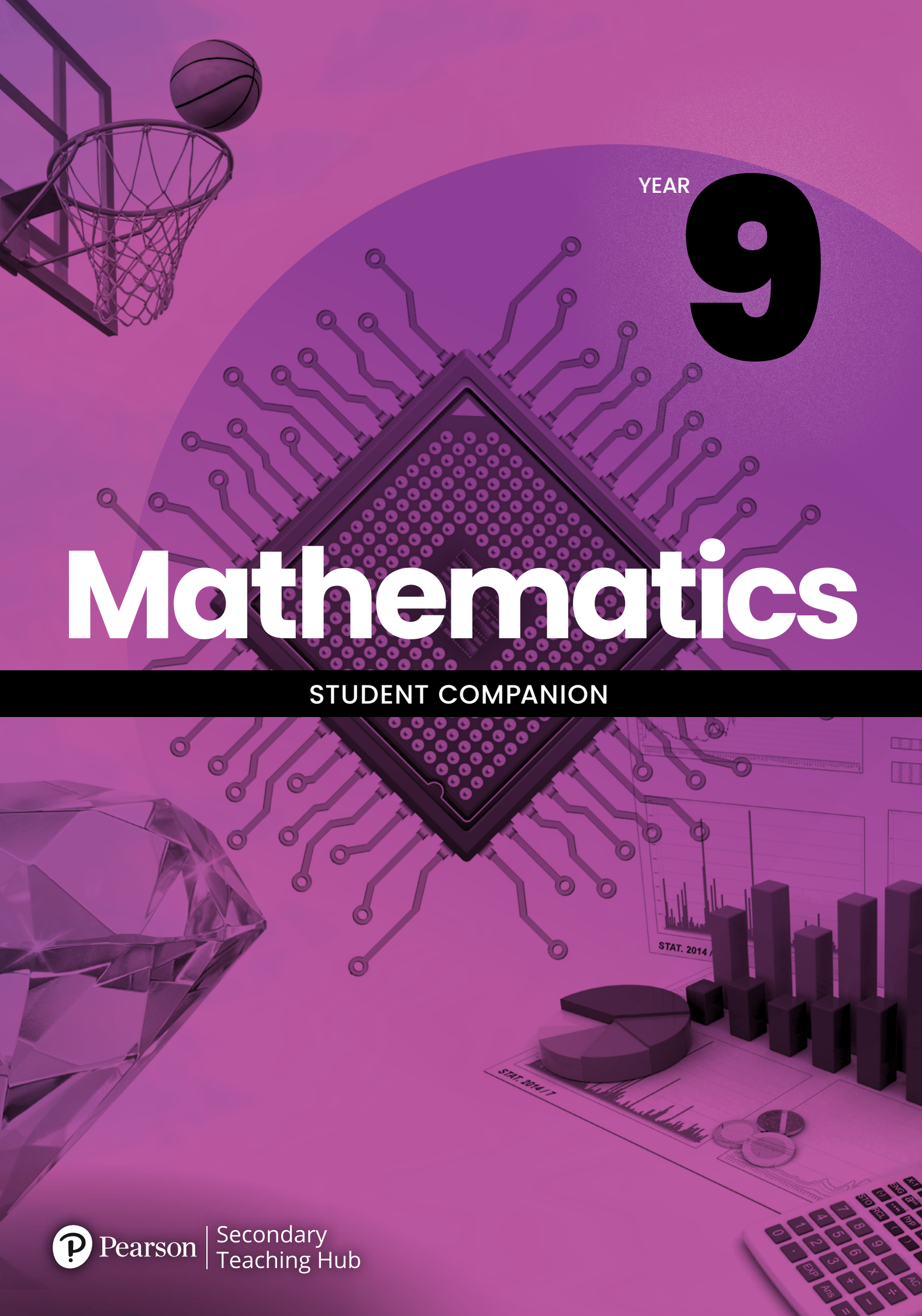

YEAR 9

Mathematics

STUDENT COMPANION

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Pearson Secondary Teaching Hub Maths 9

Student Companion

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Pearson acknowledges the Traditional Custodians of the lands upon which the many schools throughout Australia are located.

We respect the living cultures of Aboriginal and Torres Strait Islander peoples and their ongoing connection to Country across lands, sky, seas, waterways and communities. We celebrate the richness of Indigenous Knowledge systems, shared with us and with schools Australia-wide.

We pay our respects to Elders, past and present.

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How to use this Student Companion

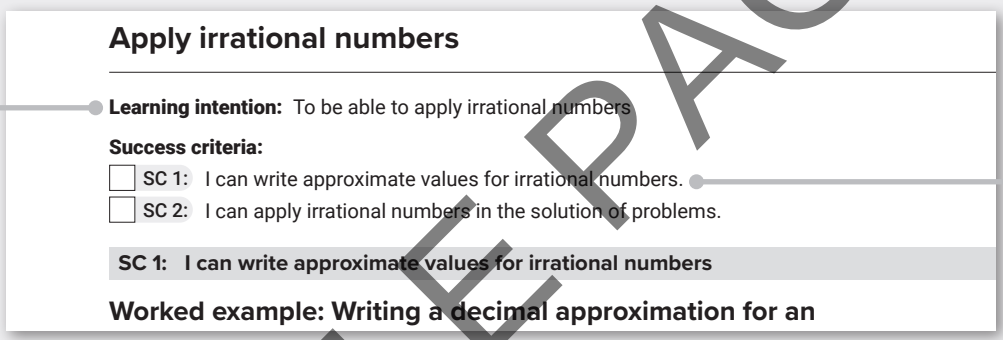
The *Student Companion* is a complementary resource that offers a print medium for corresponding lessons in *Pearson Secondary Teaching Hub*. It is designed to support teaching and learning by providing learners with a place to create a portfolio of learning to suit their individual needs, whether you are:

- supporting a blended classroom using the strengths of print and digital
- preparing for exams by creating a study guide or bound reference
- needing a tool to differentiate learning or
- looking for meaningful homework tasks.

Learners can develop their portfolio of learning as part of classroom learning or at home as an additional opportunity to engage and re-engage with the knowledge and skills from the lesson.

This could be done as prior learning in a flipped classroom environment or as an additional revision or homework task.

Learning intention and success criteria



Learning intentions are provided for every lesson. The learning intentions are goals or objectives that align to the corresponding digital lesson. They describe what learners should know, understand or be able to do by the end of the lesson.

Success criteria clarify expectations and describe what success looks like. The success criteria are specific, concrete and measurable so learners can actively engage with and reflect on their evidence of learning within each lesson.

Worked examples

Worked examples provide learners with a step-by-step solution to a problem. The worked examples in the *Student Companion* correspond to those in the digital lesson and are provided for each skill to:

- scaffold learning
- support skill acquisition
- reduce the cognitive load.

The **worked examples** are an effective tool to demonstrate what success looks like. The 'try yourself' format of the worked examples in the *Student Companion* support the gradual release of responsibility. Learners can view a completed worked example and a video walkthrough of the worked example in the corresponding digital lesson and then apply the scaffolded steps themselves to solve a unique problem.

Practice questions are provided in the *Student Companion* so that learners can apply the knowledge and skills obtained in the worked example given. These questions are designed to ensure learners build confidence and demonstrate efficiency. They follow on from the Check your understanding questions beside the corresponding worked example in the digital lesson.

Each lesson in the *Student Companion* contains a space for students to reflect on their understanding. The simple and intuitive design of the **lesson reflection tool** allows students to scale their confidence, reflect on their learning and identify areas in which they need support.

SC 2: I can apply irrational numbers in the solution of problems

Worked example: Calculating exact lengths that have irrational values and then give a decimal approximation

Calculate the following lengths in exact form, then approximate the lengths correct to 1 decimal place.

(a) The exact circumference of a circle of diameter 8 cm

Thinking	Working
Recall the formula for the circumference of a circle.	
Substitute the known values and simplify.	
Write the answer.	

(b) The exact length of the diagonal of a square of side length 6 cm

Thinking	Working
Draw a diagram showing a right-angled triangle, marking the length to be calculated as x.	
Recall Pythagoras' theorem for right-angled triangles.	
Substitute the known values and simplify.	
Take the square root of the number, ignoring the possibility of a negative value, since lengths are positive.	
Write the answer.	

1 For the circle shown, use the following rules.

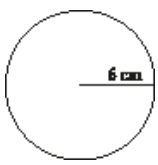
(a) $C = 2\pi r$ to calculate the circumference

(b) $A = \pi r^2$ to calculate the area

Give your answers

(i) in exact form, and

(ii) accurate to 2 decimal places.



(a) _____

(b) _____

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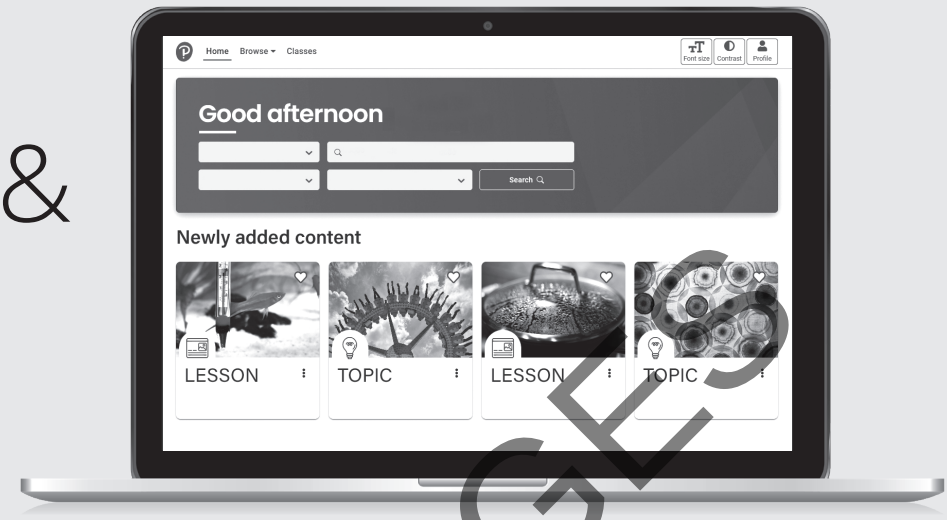
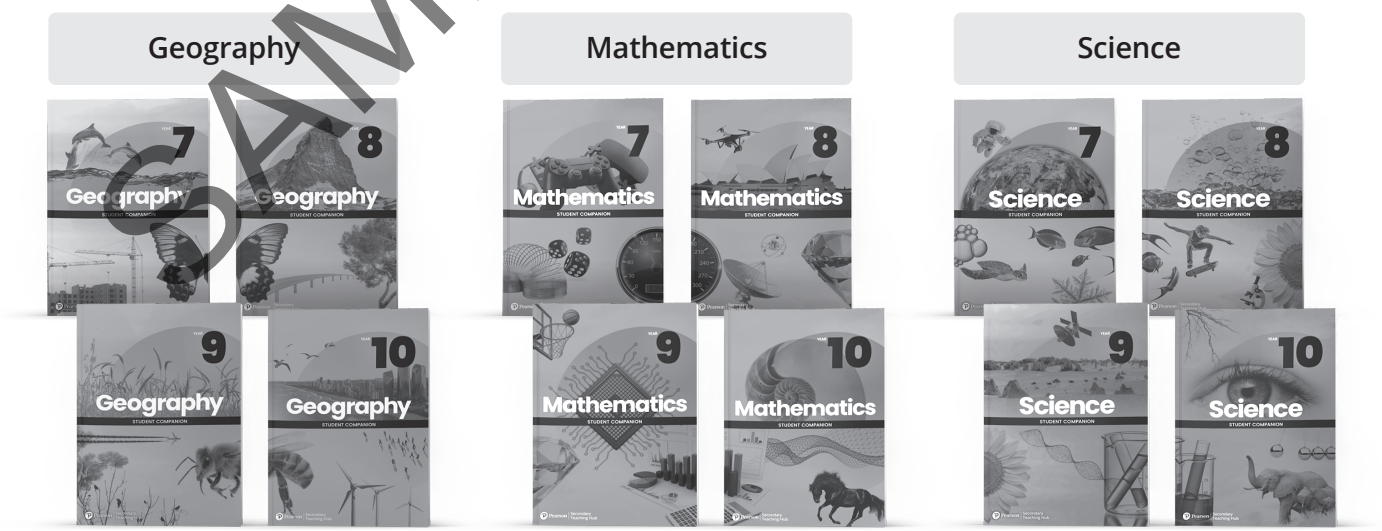
Simplify teaching & energise learning



Discover *Pearson Secondary Teaching Hub* for years 7 to 10.

Pearson Secondary Teaching Hub has been designed to simplify teaching and energise learning across multiple subjects. Every *Secondary Teaching Hub* subject offers best-practice learning design delivered in flexible formats for the modern classroom, plus uniquely developed content structures and features for each subject.

This solution provides continuity for students from one class to the next and a rare whole-school view for school leadership while still delivering the rigour and support teachers need to help students meet the specific outcomes of their curriculum area.



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Real numbers

Identify and define irrational numbers

Learning intention: To be able to identify and define irrational numbers

Success criteria:

- ☐ SC 1: I can define a rational number and determine whether a number is rational or irrational.
- ☐ SC 2: I can use a number line to indicate the solution interval for inequalities.

SC 1: I can define a rational number and determine whether a number is rational or irrational

Worked example: Identifying rational numbers in a list

Label each of the following numbers as either rational or irrational.
$\sqrt{64}, 15\pi, -5.27, 2.\dot{7}, \sqrt{125}$ and $\sqrt[3]{-27}$

Thinking	Working
Recall the definition of a rational number.	A number that is rational can be written in the form $\frac{a}{b}$.
Examine the square roots.	
Examine the cube root.	
Identify any recurring and terminating decimals. Recurring and terminating decimals are rational.	
Identify any terms that contain transcendental numbers (π or e), which are irrational.	

1 Label each of the following numbers as rational or irrational. For the rational numbers, show the value expressed in the form $\frac{a}{b}$, where a and b are integers.

(a) $5\frac{1}{3}$ **(b)** $\sqrt{1000}$ **(c)** $\sqrt[3]{800}$

(d) 58π **(e)** $6.\dot{2}$ **(f)** $-\sqrt{400}$

2 Express each of the following numbers in the form $\frac{a}{b}$, thus confirming they are rational. In each case, express the fraction in simplest form.

(a) $3.2525\ldots$ **(b)** $0.7\dot{2}$ **(c)** $6.\overline{003}$ **(d)** $1.5\dot{2}0\dot{2}$

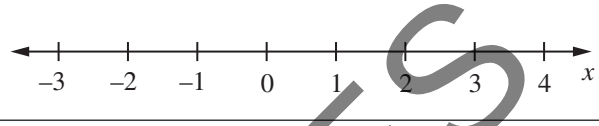
RATE MY LEARNING ○ I need some help ○ I am getting there ○ I get it ○ I am confident

SC 2: I can use a number line to indicate the solution interval for inequalities

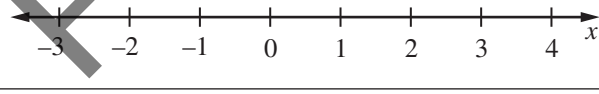
Worked example: Showing a solution interval on a number line

Show the following intervals on a number line.

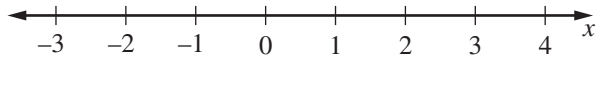
(a) $-2 \leq x < 3$

Thinking	Working
Plot the endpoints on the number line using a closed circle for an included value and an open circle if it is not included. Complete the number line with a line segment between the plotted points.	

(b) $x + 5 < 3$

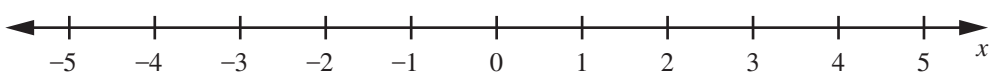
Thinking	Working
Solve the inequality to determine the value of the unknown.	
Plot the endpoint on the number line using an open circle because the end value is not included. Complete the number line with a line and arrow.	

(c) $-4x \leq 6$

Thinking	Working
Solve the inequality to determine the value of the unknown. Note that when multiplying or dividing by a negative number, the inequality sign is reversed.	
Plot the endpoint on the number line using a closed circle for the included end value. Complete the number line with a line and arrow.	

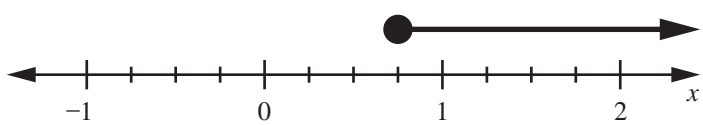
1 Draw and label the following solution intervals on the number line below.

(a) $x < -1$ **(b)** $x \geq 3$ **(c)** $-1 < x \leq 2$

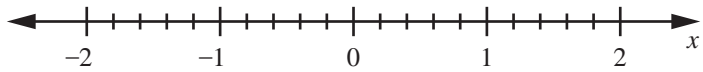


2 State the solution interval shown in each of the following diagrams.

(a)



(b)



(c)

3 Solve each of the following inequalities and show the solution interval on a number line.

(a) $2x + 1 \geq 4$

(b) $6x + 12 \leq -3$

(c) $5 - 4x > -2$

RATE MY LEARNING

I need some help | I am getting there | I get it | I am confident

Apply irrational numbers

Learning intention: To be able to apply irrational numbers

Success criteria:

- ☐ SC 1: I can write approximate values for irrational numbers.
- ☐ SC 2: I can apply irrational numbers in the solution of problems.

SC 1: I can write approximate values for irrational numbers

Worked example: Writing a decimal approximation for an irrational number

Write the value of $\sqrt{8}$ correct to 2 decimal places and 4 decimal places.

Thinking	Working
Use your calculator to obtain a value for the irrational number. Examine the third digit after the decimal point. If the digit is 0–4, round down. If the digit is 5–9, round up. Examine the fifth digit after the decimal point and round as before.	

1 Write each of the following irrational numbers as a decimal correct to

(i) 1 decimal place

(ii) 4 decimal places.

(a) $\sqrt{13}$ **(b)** $\sqrt{40}$ **(c)** $\sqrt[3]{16}$ **(d)** $\sqrt[3]{75}$

2 Write each of the following irrational numbers as a decimal correct to

(i) 1 decimal place

(ii) 4 decimal places.

(a) $5\pi + 9$ **(b)** $\dfrac{7\pi}{8}$

(c) $e + 6$ **(d)** $\dfrac{5e + 2}{4}$

RATE MY LEARNING ○ I need some help ○ I am getting there ○ I get it ○ I am confident

SC 2: I can apply irrational numbers in the solution of problems

Worked example: Calculating exact lengths that have irrational values and then give a decimal approximation

Calculate the following lengths in exact form, then approximate the lengths correct to 1 decimal place.

(a) The exact circumference of a circle of diameter 8 cm

Thinking	Working
Recall the formula for the circumference of a circle.	
Substitute the known values and simplify.	
Write the answer.	

(b) The exact length of the diagonal of a square of side length 6 cm

Thinking	Working
Draw a diagram showing a right-angled triangle, marking the length to be calculated as x.	
Recall Pythagoras' theorem for right-angled triangles.	
Substitute the known values and simplify.	
Take the square root of the number, ignoring the possibility of a negative value, since lengths are positive.	
Write the answer.	

1 For the circle shown, use the following rules.

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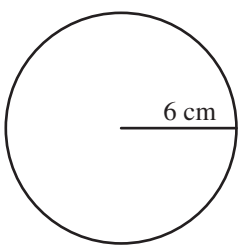

(a) _____

(b) _____

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Plot and locate irrational numbers on a number line by estimation and by construction

Learning intention: To be able to plot and locate irrational numbers on a number line by estimation and by construction

Success criteria:

- ☐ SC 1: I can estimate the location of irrational numbers on a number line.
- ☐ SC 2: I can use construction techniques to accurately locate irrational numbers on a number line.

SC 1: I can estimate the location of irrational numbers on a number line

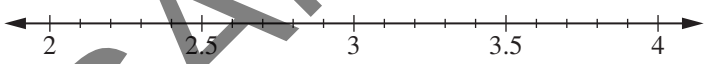
Worked example: Plotting an approximate value for an irrational number on a number line

Write the value of 2π correct to 2 decimal places and plot its position on a number line.

Thinking	Working
Write the approximate value of the irrational number.	
Identify more rounded values above and below the approximation.	
Draw a number line showing the approximate value.	

1 Plot each of the following irrational numbers on the number line below.

$\sqrt{10}, \sqrt{5}, \frac{3\pi}{4}, \frac{e^2}{2}$



2 List the following irrational numbers $\sqrt{12}, \sqrt[3]{-15}, -\frac{5\pi}{2}, \sqrt{14}, -\sqrt[3]{20}, \sqrt[3]{6}, -\frac{3e}{2}$ in

(a) ascending order

(b) descending order.

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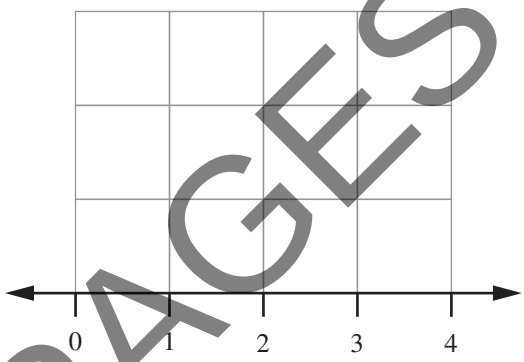
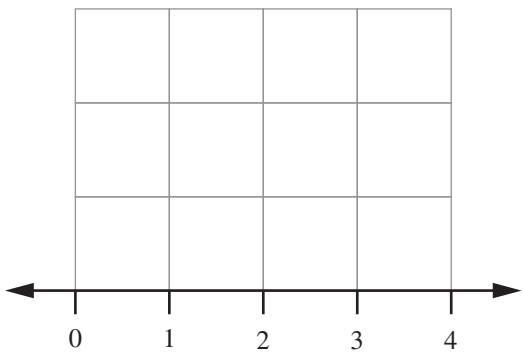
SC 2: I can use construction techniques to accurately locate irrational numbers on a number line

Worked example: Using construction to show the location of an irrational number on a number line

(a) Construct a right-angled triangle on a number line and use the construction to plot the position of $\sqrt{5}$.

Thinking	Working
Write 5 as the sum of two square numbers.	
Use Pythagoras' theorem to determine the side lengths. Draw a right-angled triangle on grid paper, with base 2, height 1 and hypotenuse $\sqrt{5}$.	
Set the compass radius to the length of the hypotenuse ($\sqrt{5}$ units). With the compass point at 0, draw an arc from the vertex to the number line. Mark the point at which the arc intersects the number line as the location of $\sqrt{5}$.	

(b) Use the construction in **(a)** to plot the position of $\sqrt{10}$ on the number line.

Thinking	Working
Write 10 as the sum of two squares of either whole numbers, or lengths on the original construction.	
Draw a right-angled triangle on grid paper, with base $\sqrt{5}$, height $\sqrt{5}$ and hypotenuse $\sqrt{10}$. Set the compass radius to the length of the hypotenuse ($\sqrt{10}$ units). With the compass point at 0, draw an arc from the vertex to the number line. Mark the point at which the arc intersects the number line as the location of $\sqrt{10}$.	

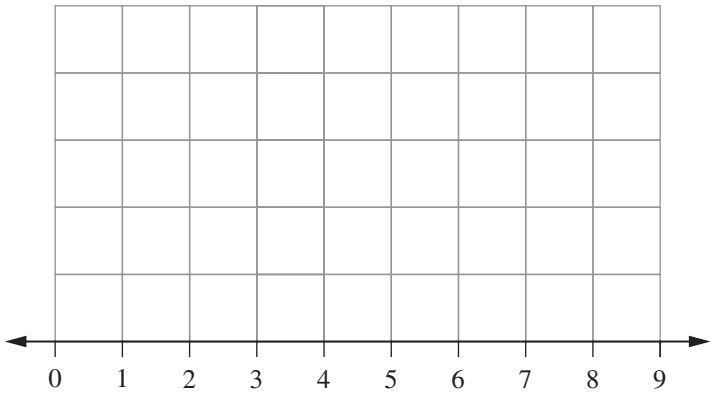
1 Write each of the following numbers as the sum of two positive square numbers, and hence write the side lengths of a right-angled triangle for which the lengths of the shorter sides are whole numbers of units and the length of the hypotenuse involves a surd.

(a) 26 **(b)** 32 **(c)** 34

2 On the number line and grid below:

(a) construct a right-angled triangle with a hypotenuse of $\sqrt{45}$ units and draw an arc to the number line

(b) use the construction in part **(a)** to form a right-angled triangle to enable $\sqrt{61}$ to be plotted on the number line.



3 **(a)** Write your own instructions for how you can construct a length of $\sqrt{130}$ cm using a ruler and a compass.

(b) Draw the construction from part (a).

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