Junior Maths
Pathways

Year 9 Number

Connecting Fractions Decimals and Percentages

One concept | Five progress indicators

1 Emerging	2 Developing	3 Consolidating	4 Proficient	5 Exceeding

FREE SAMPLE

Teacher guide | Student activities | Complete answers

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Teacher Guide

Year 9 Number | Fractions decimals and percentages

Purpose

This booklet develops the idea that fractions, decimals, and percentages can name the same quantity. Students connect models, division, hundredths, and number lines before using conversion procedures. Activities linked to the five progress indicators vary support and challenge while preserving the same central mathematics.

Learning intentions

- Represent the same quantity as a fraction, decimal, and percentage.
- Explain why a conversion method works.
- Compare and order quantities written in different forms.
- Use a scientific calculator appropriately and check whether its display is reasonable.

Success criteria

- I can connect a fraction, decimal, percentage, model, and number-line position.
- I can choose an efficient form for comparing values.
- I can estimate before using a calculator and interpret the display.
- I can justify an answer using a representation or mathematical relationship.

Curriculum Alignment

Curriculum wording and the learning addressed in this resource

Curriculum field	Alignment
Learning area	Mathematics and Statistics
Phase and year	Phase 4 | During Year 9
Strand	Number
Curriculum element	Number structures and operations
Concept focus	Connecting fractions, decimals and percentages

Curriculum Knowledge

The following knowledge statements are reproduced from the Year 9 teaching sequence in the refreshed New Zealand Curriculum:

- There are an infinite number of rational numbers between any two numbers; these can be represented by terminating decimals, recurring decimals, and fractions.
- Numbers, including fractions, decimals, and percentages, can be represented using number lines.
- Percentages are a way of expressing a fraction of 100.

Curriculum Practices

- Identifying, reading, writing, representing, comparing, ordering, and converting between fractions, decimals, and percentages.

Prior knowledge revisited

Equal-part models, division as a fraction, decimal place value to hundredths, and familiar benchmark fractions are revisited to support access to the Year 9 learning. These are supporting foundations, not additional Year 9 curriculum claims.

How this resource addresses the curriculum

Students use area models, benchmark values, equivalent forms and number lines before applying efficient conversion methods. They compare and order quantities, then explain and justify their reasoning through written responses, error analysis and generalisation.

Curriculum source: Mathematics and Statistics Phase 4 Years 9–10

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Teaching and Assessment Notes

Suggested Timing and Lesson Breaks

Suggested lesson breaks indicate sensible places where teaching can pause without interrupting the development of an important idea. They are optional and allow the booklet to be used flexibly across lessons of different lengths.

Phase	Suggested time	Suggested lesson break
Five Step Progress Check	10–15 min	Five Step Progress Check — page 6
Concept investigation	25–40 min	Notice and Explain — page 7
Progress activities	35–60 min	Progress Activities — page 11
Progress check	15–25 min	Reflection — page 16

Total suggested time is 90–150 minutes. The booklet may be taught across two or three lessons. Use current evidence to choose an appropriate starting point; students do not need to complete every progress section.

Choosing a Starting Point

Use the progress indicators to identify an appropriate starting point for this concept. This is not a permanent label. Students may begin at different points for different concepts and move between activities as their understanding develops.

Progress indicator	Use this starting point when the student benefits from or is ready for
1 Emerging	Visual models, familiar benchmark fractions and full prompts
2 Developing	Guided conversions and structured comparison
3 Consolidating	Independent conversions, ordering and explanation
4 Proficient	Strategic choices in less familiar contexts
5 Exceeding	Generalisations, error analysis and non-routine reasoning

Calculator Use and Teacher Preparation

Calculator guidance is based on the Casio fx-82AU PLUS II, 2nd edition. Equivalent keys may be used on other scientific calculators. Calculator use follows four steps: understand the quantity, estimate the result, enter the calculation, and interpret and check the display.

Label	Meaning
Think first	Estimate or identify a benchmark before pressing keys.
Calculator use	Use division to obtain a decimal when a fraction is not familiar.
Check the display	Decide whether the displayed value is exact or rounded and whether it is reasonable.

Teacher preparation

- Print the Five Step Progress Check and the progress activities appropriate for each student.
- Have scientific calculators available for questions marked Calculator use.
- Allow students to use diagrams, written reasoning and oral explanation.
- Use the progress check to decide whether students should consolidate or move forward.

Five Step Progress Check

Complete without a calculator. Each question provides evidence for an appropriate starting point.

1. Match the three equivalent forms: $\frac{1}{2}$, 0.5, 50%. Use a diagram or words to show why they name the same amount.

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2. Convert $\frac{3}{5}$ to a decimal and a percentage. Show the steps you use.

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3. Place 0.62, $\frac{5}{8}$, and 61% in ascending order. Record a common form that supports your ordering.

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4. Which is greater: $\frac{7}{12}$ or 58%? Explain an efficient way to decide and state whether an approximation is involved.

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5. A student claims that every fraction has an exact terminating decimal. Decide whether the claim is true. Use examples and explain how a calculator display could be misleading.

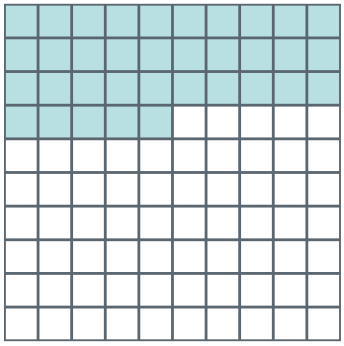
Concept Investigation

One quantity can have several names

Explore

A hundred-square has 100 equal cells. Imagine that 35 cells are shaded.

35 hundredths = 0.35 = 35%



Each small square is
1 hundredth of the whole.

The shaded region has
three equivalent names.

A hundred-square makes the connection between hundredths, decimals and percentages visible.

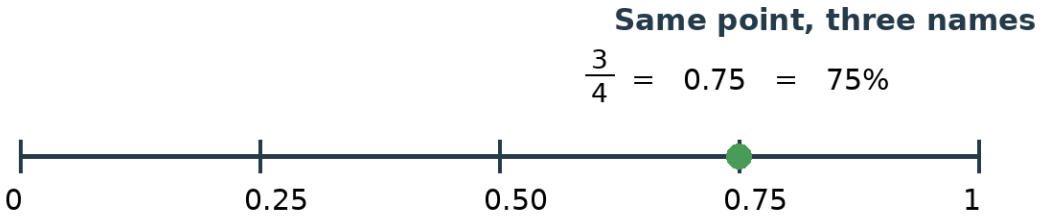
Fraction of the square	Decimal of the square	Percentage of the square
$\frac{35}{100}$	0.35	35%

All three expressions name the same shaded amount. The fraction counts 35 hundredths. The decimal records 35 hundredths using place value. The percentage says 35 out of every 100.

Connect

Representation	Meaning	Equivalent name
$\frac{3}{4}$	3 ÷ 4	0.75 = 75%
$\frac{1}{5}$	1 ÷ 5	0.2 = 20%
$\frac{7}{10}$	7 tenths	0.7 = 70%
$\frac{125}{100}$	125 hundredths	1.25 = 125%

Notice and Explain



Equivalent forms occupy the same position on a number line.

1. Why does multiplying a decimal by 100 give the number of hundredths in the equivalent percentage?

2. Why is 125% greater than one whole?

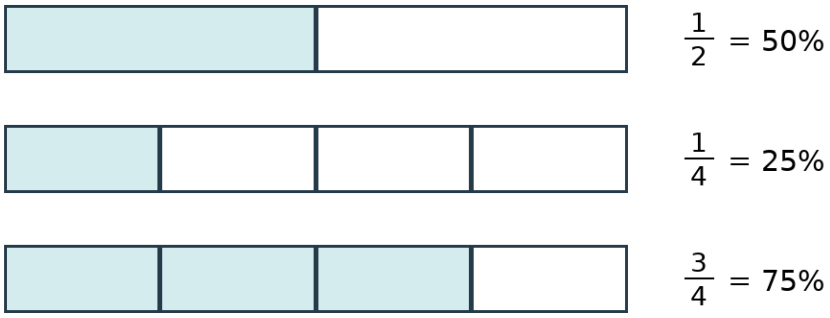
3. Explain why $\frac{3}{4}$ and $\frac{75}{100}$ occupy the same point on a number line.

Calculator Use

To convert $\frac{7}{16}$ to a decimal, first estimate: $\frac{7}{16}$ is a little less than $\frac{1}{2}$, so the decimal should be a little less than 0.5. Enter 7 ÷ 16 =. The display is 0.4375. Multiply the decimal by 100 to write 43.75%. Check: 43.75% is slightly less than 50%, which matches the estimate.

Making the Methods Meaningful

Benchmark fraction models



Area models support benchmark comparisons before formal conversion methods are used.

Fraction to decimal to percentage

1. Interpret the fraction bar as division. For $\frac{3}{8}$, calculate 3 ÷ 8 = 0.375.
2. Read 0.375 as 375 thousandths.
3. Multiply by 100 to express the quantity per hundred: 0.375 × 100 = 37.5%.
4. Check against a benchmark: $\frac{3}{8}$ is less than $\frac{1}{2}$, so the result must be less than 50%.

Percentage to decimal to fraction

1. Interpret 62% as 62 out of 100.
2. Write $\frac{62}{100}$ and divide by 100 to write 0.62.
3. Simplify $\frac{62}{100}$ by dividing numerator and denominator by 2: $\frac{31}{50}$.
4. Check that all three forms are between $\frac{1}{2}$ and $\frac{3}{4}$.

Comparing mixed forms

Choose a common representation. To compare $\frac{5}{8}$, 0.61, and 63%, change each to a decimal or percentage: $\frac{5}{8}$ = 0.625 = 62.5%, 0.61 = 61%, and 63% = 0.63. Therefore 0.61 < $\frac{5}{8}$ < 63%.

Common misconceptions

Misconception	Question that exposes the idea	Useful response
A larger denominator makes a larger fraction	Which is larger, $\frac{1}{4}$ or $\frac{1}{8}$?	Compare equal wholes using a model or benchmark.

Misconception	Question that exposes the idea	Useful response
0.4 means 4%	How many hundredths are in four tenths?	Rename 0.4 as $\frac{40}{100}$, so it is 40%.
Percentages cannot exceed 100%	What is 150% of one whole?	Use one whole plus another half.
Calculator display is automatically meaningful	Is 7 ÷ 16 likely to be 4.375?	Estimate before entry and check place value.

Progress Indicator 1 Emerging

Build the foundation with visual and benchmark connections

Use diagrams and explain each connection

1. Complete: $\frac{3}{10}$ = ___ tenths = 0.___ = ___%.

2. Complete: $\frac{25}{100}$ = 0.___ = ___%.

3. Draw a bar split into four equal parts. Shade $\frac{1}{4}$. Write its decimal and percentage.

4. Match each fraction to a decimal and percentage: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$; 0.25, 0.50, 0.75; 25%, 50%, 75%.

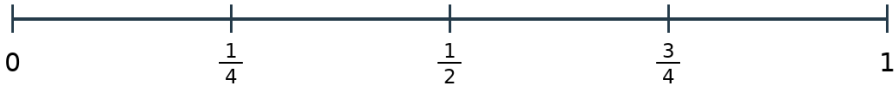
5. Place 0%, 25%, 50%, 75%, and 100% on a number line from 0 to 1.

6. Circle the larger value in each pair: 0.3 or 25%; $\frac{3}{4}$ or 70%; 0.9 or 95%.

7. Explain why 0.6 and 60% are equivalent.

8. Think first: Is $\frac{2}{5}$ less than or greater than $\frac{1}{2}$? Then calculate 2 ÷ 5. Write the decimal and percentage.

Label each point with its decimal and percentage.



Use the number line to annotate equivalent decimal and percentage forms.

Progress Indicator 2 Developing

Use guided steps to connect and compare

Show each conversion step

1. Complete the equivalent forms:

a) $\frac{7}{10}$ = _____ = _____ %

b) $\frac{18}{100}$ = _____ = _____ %

c) 0.45 = $\frac{\quad}{100}$ = _____ %.

2. Convert: a) $\frac{3}{5}$ to a decimal and percentage b) $\frac{7}{20}$ to a decimal and percentage c) 65% to a decimal and simplified fraction.

3. Order from least to greatest: 0.42, $\frac{2}{5}$, 45%. Show a common form.

4. Insert <, >, or =: a) 0.8 ___ 78% b) $\frac{3}{10}$ ___ 0.3 c) $\frac{5}{8}$ ___ 60%.

5. A class survey shows that 12 out of 20 students prefer walking. Express this as a fraction, decimal, and percentage.

6. Calculator use: Estimate whether $\frac{11}{25}$ is below or above 50%. Enter 11 ÷ 25. Record the decimal and percentage, then check the estimate.

7. Explain the error: Hana writes 0.07 = 70% because she sees the digit 7.

8. Create a fraction that is between 30% and 40%. Prove that it fits.

Progress Indicator 3 Consolidating

Convert compare and justify independently

Choose an efficient representation

1. Convert each to the other two forms: a) $\frac{7}{8}$ b) 0.32 c) 135% d) $\frac{9}{20}$

2. Order from least to greatest: $\frac{5}{6}$, 0.81, 82%, $\frac{4}{5}$. Record one common form.

3. Which is closer to $\frac{1}{2}$: 47% or $\frac{13}{25}$? Explain without relying only on a calculator.

4. A drink mixture is 0.375 fruit juice. Write this as a percentage and a simplified fraction.

5. A learner completed 21 of 24 tasks. Express the completed part as a fraction, decimal, and percentage.

6. Calculator use: Convert $\frac{5}{12}$ to a decimal. The display continues beyond the visible digits. Record an appropriate rounded percentage and state the rounding used.

7. Write two different fractions equivalent to 62.5%. Explain how you know.

8. A student says $\frac{3}{7}$ must equal 42% exactly because 3 ÷ 7 begins 0.42. Identify what is missing from the statement.

Progress Indicator 4 Proficient

Make strategic choices and reason in context

Explain why your method is efficient

1. Without calculating every decimal, order 49%, $\frac{1}{2}$, and 0.505. Explain your benchmark reasoning.

2. Three students completed $\frac{17}{20}$, 0.83, and 84% of a challenge. Rank the results and state the gap between the highest and lowest in percentage points.

3. A store advertises $\frac{3}{8}$ off one item and 37% off another. Which discount is larger? Justify the comparison.

4. Calculator use: A team won 13 of 18 games. Estimate first, then give the win rate to the nearest whole percent. Explain why the answer is an approximation.

5. Find the fraction with a denominator less than 20 whose percentage is closest to 36%. Show the fractions you tested and explain how you decided which was closest.

6. Is the statement always, sometimes, or never true? “If one decimal has more digits than another, it represents the larger number.” Provide evidence.

7. A quantity is written as 0.6, 60%, and $\frac{3}{5}$. Which form is most useful for a) locating it on a hundred-square, b) sharing 3 objects equally among 5 people, and c) comparing it with 58%? Explain.

8. Design one comparison question where converting to percentages is efficient and another where using benchmark fractions is more efficient. Include answers.

Progress Indicator 5 Exceeding

Generalise critique and solve non-routine problems

Use structure and defend your conclusions

1. For a fraction $\frac{a}{b}$, explain why the equivalent percentage can be written as $(\frac{100a}{b})\%$. State any condition on b.

2. A decimal terminates when written exactly, but another repeats. Investigate $\frac{3}{40}$ and $\frac{3}{14}$. Explain what the calculator display can and cannot prove.

3. Find all fractions with denominator 12 that lie strictly between 40% and 75%. Give simplified forms where appropriate.

4. A student claims that multiplying a number by 100 changes its value, so 0.37 cannot equal 37%. Critique the claim carefully.

5. A survey percentage was rounded to 63% from a sample of 30 people. Find all possible whole-number response counts that could produce 63% when rounded to the nearest whole percent.

6. Construct three different quantities that all round to 0.67 to two decimal places but give different percentages to one decimal place.

7. Create and solve a problem in which choosing a fraction is more revealing than choosing a decimal or percentage. Explain the choice.

8. Generalise a quick test for deciding whether a fraction is greater than 50% without dividing. Prove why the test works.

Progress Check

Complete independently after your selected progress activities

1. Represent $\frac{7}{20}$ as a decimal and percentage.

2. Represent 0.875 as a percentage and simplified fraction.

3. Order 0.58, $\frac{3}{5}$, and 57% from least to greatest.

4. Place 125% on a number line marked 0, $\frac{1}{2}$, 1, and $\frac{3}{2}$. Explain its position.

5. Calculator use: Convert $\frac{7}{9}$ to a percentage to one decimal place. State why rounding is needed.

6. Tama says $\frac{4}{9}$ is greater than 45% because 4 is greater than 45 when the percent sign is removed. Explain and correct his reasoning.

7. Write one quantity in fraction, decimal, and percentage form. Use a representation or calculation to prove that the forms are equivalent.

Reflection

The representation I found most useful was _____ because _____.

My next step is _____.

Teacher Copy Answers

Five Step Progress Check

Each question increases in conceptual demand. Use the highest question answered securely, together with classroom observations and previous evidence, to choose an appropriate starting point. This is a brief diagnostic, not a grade.

Question	Answer and teaching note
1	$\frac{1}{2}$ = 0.5 = 50%. The representation should show one of two equal parts or an equivalent half.
2	$\frac{3}{5}$ = 3 ÷ 5 = 0.6 = 60%. Look for a meaningful link between division and hundredths.
3	61% = 0.61 < 0.62 < $\frac{5}{8}$ = 0.625.
4	$\frac{7}{12}$ = 0.5833..., so it is slightly greater than 58% = 0.58. An estimate using $\frac{7}{12} \approx$ 58.3% is sufficient if the rounding is identified.
5	The claim is false. For example, $\frac{1}{2}$ = 0.5 terminates but $\frac{1}{3}$ = 0.333... repeats. A finite calculator screen may round or truncate a repeating decimal.

Suggested Starting Indicator

Evidence from the check	Possible starting point
Question 1 is not yet secure	Indicator 1 Emerging
Question 1 is secure; Question 2 needs support	Indicator 2 Developing
Questions 1 and 2 are secure; Question 3 needs support	Indicator 3 Consolidating
Questions 1 to 3 are secure; Question 4 reasoning is developing	Indicator 4 Proficient
Questions 1 to 4 are secure and Question 5 shows generalisation	Indicator 5 Exceeding

Treat this starting point as provisional. A student may work with activities from another indicator as the evidence changes.

Concept investigation

Prompt	Indicative response
Why multiply a decimal by 100?	A percentage counts hundredths. Multiplying the numerical decimal by 100 identifies how many hundredths; the percent symbol means “per hundred”, so the represented quantity remains equivalent.
Why is 125% greater than one?	100% is one whole. Another 25% is one quarter, so 125% = 1.25 = $\frac{5}{4}$.
Why do $\frac{3}{4}$ and $\frac{75}{100}$ share a point?	Multiplying $\frac{3}{4}$ by $\frac{25}{25}$ gives $\frac{75}{100}$. Multiplication by an equivalent form of 1 does not change the value.

Accept equivalent explanations supported by diagrams, calculations, number lines, or clear oral reasoning.

Teacher Copy Answers

Progress Indicator 1 Emerging

Q	Answer
1	3 tenths; 0.3; 30%.
2	0.25; 25%.
3	$\frac{1}{4}$ = 0.25 = 25%; one of four equal parts shaded.
4	$\frac{1}{2}$ ↔ 0.50 ↔ 50%; $\frac{1}{4}$ ↔ 0.25 ↔ 25%; $\frac{3}{4}$ ↔ 0.75 ↔ 75%.
5	Equally spaced in this order: 0%, 25%, 50%, 75%, 100%.
6	0.3; $\frac{3}{4}$; 95%.
7	0.6 is six tenths, which is 60 hundredths; 60 hundredths is 60%.
8	Less than $\frac{1}{2}$; 2 ÷ 5 = 0.4 = 40%.

Teacher Copy Answers

Progress Indicator 2 Developing

Q	Answer
1	a) 0.7, 70% b) 0.18, 18% c) $\frac{45}{100}$, 45%.
2	a) 0.6, 60% b) 0.35, 35% c) 0.65, $\frac{13}{20}$.
3	$\frac{2}{5}$ = 0.40, so $\frac{2}{5}$ < 0.42 < 45%.
4	a) > b) = c) > because $\frac{5}{8}$ = 0.625 = 62.5%.
5	$\frac{12}{20} = \frac{3}{5}$ = 0.6 = 60%.
6	Below 50%; 11 ÷ 25 = 0.44 = 44%.
7	0.07 is seven hundredths, so it is 7%, not 70%.
8	Examples vary. $\frac{1}{3}$ = 33⅓% is valid.

Teacher Copy Answers

Progress Indicator 3 Consolidating

Q	Answer and reasoning
1	a) $\frac{7}{8}$ = 0.875 = 87.5%. b) 0.32 = 32% = $\frac{8}{25}$. c) 135% = 1.35 = $\frac{27}{20}$. d) $\frac{9}{20}$ = 0.45 = 45%.
2	$\frac{4}{5}$ = 0.80, 0.81, 82% = 0.82, $\frac{5}{6}$ ≈ 0.8333; therefore $\frac{4}{5}$ < 0.81 < 82% < $\frac{5}{6}$.
3	47% is 3 percentage points from 50%. $\frac{13}{25}$ = 52%, which is 2 percentage points from 50%, so $\frac{13}{25}$ is closer.
4	0.375 = 37.5% = $\frac{3}{8}$.
5	$\frac{21}{24}$ = $\frac{7}{8}$ = 0.875 = 87.5%.
6	$\frac{5}{12}$ = 0.41666… = 41.666…%. For example, 41.7% to one decimal place. Rounding is needed because the decimal repeats.
7	Examples: $\frac{5}{8}$ and $\frac{10}{16}$. Both equal 0.625 = 62.5%.
8	$\frac{3}{7}$ = 0.428571… = 42.8571…%, so 42% is not exact. The statement omits the continuing digits and whether the percentage is rounded or truncated.

Teacher Copy Answers

Progress Indicator 4 Proficient

Q	Indicative answer
1	$49\% < \frac{1}{2} < 0.505$. Use $50\% = \frac{1}{2} = 0.5$ as the benchmark.
2	$\frac{17}{20} = 85\%$, then 84%, then $0.83 = 83\%$. The gap is 2 percentage points.
3	$\frac{3}{8} = 37.5\%$, so $\frac{3}{8}$ off is larger than 37% off by 0.5 percentage points.
4	$\frac{13}{18} \approx 0.7222$, so about 72% to the nearest whole percent. The fraction produces a recurring decimal, so the whole-percent value is rounded.
5	$\frac{5}{14} \approx 35.714\%$ is a strong candidate and is 0.286 percentage points from 36%. A complete answer compares nearby denominators or explains a systematic search.
6	Never. For example $0.9 > 0.81$ even though 0.81 has more digits; $0.50 = 0.5$. Place value, not digit count, determines size.
7	a) 60% aligns directly to a hundred-square. b) $\frac{3}{5}$ describes three objects shared across five. c) 60% compares directly with 58%. Other choices are acceptable with sound reasoning.
8	Questions vary. Check that each is solvable, the chosen method is genuinely efficient, and the supplied answers are correct.

Teacher Copy Answers

Progress Indicator 5 Exceeding

Q	Indicative answer
1	$\frac{a}{b}$ = a ÷ b. Multiplying by 100 gives $\frac{100a}{b}$ percentage units, so $\frac{a}{b}$ = ($\frac{100a}{b}$)%. Require b ≠ 0.
2	$\frac{3}{40}$ = 0.075 terminates. $\frac{3}{14}$ = 0.214285… repeats. A finite display alone cannot prove termination because the calculator may round or truncate. Fraction structure or exact reasoning is needed.
3	40% of 12 is 4.8 and 75% of 12 is 9. Numerators strictly between are 5, 6, 7, 8: $\frac{5}{12}, \frac{1}{2}, \frac{7}{12}, \frac{2}{3}$.
4	The number 0.37 is multiplied by 100 to count hundredths, then labelled percent. 37% means $\frac{37}{100}$ = 0.37, so the representation changes but the quantity does not.
5	$\frac{19}{30}$ = 63.333…%, which rounds to 63%. No other whole count out of 30 lies in the rounding interval 62.5% to below 63.5%.
6	Examples: 0.665, 0.666 and 0.674 all round to 0.67 to two decimal places; as percentages to one decimal place they are 66.5%, 66.6%, and 67.4%.
7	Problems vary. Look for a context where part-whole structure, exact sharing, or ratio is clearer as a fraction.
8	For positive b, $\frac{a}{b} > \frac{1}{2}$ exactly when 2a > b. Multiplying both sides by positive 2b preserves the inequality: $\frac{a}{b} > \frac{1}{2} \Leftrightarrow$ 2a > b.

Teacher Copy Answers

Progress check and next teaching decisions

Q	Answer
1	$\frac{7}{20} = 0.35 = 35\%$.
2	$0.875 = 87.5\% = \frac{7}{8}$.
3	$57\% = 0.57 < 0.58 < \frac{3}{5} = 0.60$.
4	$125\% = 1.25 = \frac{5}{4}$, halfway between 1 and $\frac{3}{2}$.
5	$\frac{7}{9} = 0.777\ldots = 77.777\ldots\%$, so 77.8% to one decimal place. Rounding is needed because the decimal repeats.
6	Compare equivalent forms: $\frac{4}{9} \approx 0.444\ldots = 44.4\ldots\%$, so 45% is greater. Removing the percent symbol changes the meaning.
7	Responses vary. Check correct equivalence and valid supporting evidence.

Next teaching decisions

- If representations are insecure, return to equal-part models and benchmark values.
- If conversions are accurate but explanations are weak, ask students to connect each procedure to hundredths, division, or a number line.
- If comparison is slow, develop strategic use of 0, $\frac{1}{2}$, 1, 50%, and 100% as benchmarks.
- If students are secure, move to finding a fraction or percentage of a quantity and finding the whole from a known part.

Curriculum source

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Open the official Phase 4 curriculum source

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