RICH MATHEMATICAL TASK BOOKLET

NUMBER & ALGEBRA

YEAR 7- 8 EVEN YEARS

Teacher Booklet

Task 1

In the shopping mall carpark, there are 138 rows for car parks. Each row has spaces for 87 cars. How many cars can fit in the carpark? Can you show your solution using two different representations?

In the shopping mall carpark, there are 172 rows for car parks. Each row has spaces for 376 cars. How many cars can fit in the carpark? Can you show your solution using two different representations?

Teacher Notes

Before the launch give students a grid for the 1 to 10 times-tables and ask students to solve them and record their time (in a non-public way).
http://www.mental-arithmetic.co.uk/multiplication-grids-pdf-generator.htm
The goal is to complete the grid in under 5 minutes so stop at 5 minutes. Get them to record their time OR how much they have completed.

This activity will be used throughout the unit and should be used as a warm-up throughout the year to develop fluency with times-tables
Prior to launching the task, ask students to calculate the following problems:
15× 10 =
100× 37 =
30 × 3000 =
Ask the students to discuss what they notice.

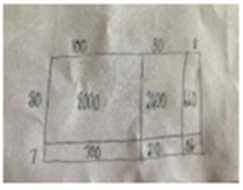
Be aware of students who rely on 'just add a 0' when dealing with base 10 multiplication. Explore what is happening to the numbers (getting bigger by base (10)) rather than rely on a misconception/rule.

Expect students to use equations and an area model to record solution strategies.
If students are using standard algorithm, check for procedural knowledge with understanding. The standard algorithm can be connected with the distributive property.

Shareback

Select student solution strategies that have used the distributive property, associative property or equivalence and compensation.
Use the correct mathematical language to describe these.

Distributive property
138 x 87 = (100 x 80) + (100 x 7) + (30 x 80) + (30 x 7) + (8 x 80) + (8 x 7)
Associative property
138 x 87 = (138 x 10 x 8) + (138 x 7)
Equivalence and compensation
138 x 87 = (138 x 90) – (138 x 3)



Big Ideas

There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship.

Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.

Patterns and relationships can be used, represented, and generalised in a variety of ways.

Mathematical Language

Distributive property, associative property, area, equivalence, compensation, factor, product

Shareback continued

Ask students to record these as equations and model representing these using the area model. If no student solves the task using the distributive property or equivalence and compensation, then introduce either solution strategy as an alternative model previously used by other students.

Connect

Ask students to describe how the following equation could be solved using the distributive property and equivalence and compensation:

157 x 62 =

Suggested Learning Outcomes

Explain and justify the use of the distributive property in multiplication.

Explain and justify the use of the associative property in multiplication.

Explain and justify the use of equivalence and compensation in multiplication.

Represent reasoning using different forms of notation including equations and an area model.

Independent Tasks

Solve the following equations:

147 x 78 =
153 x 36 =
546 x 49 =
209 x 67 =

Explain what patterns you used to help solve the equations.
Would the patterns always work?

Practise your timetables with a buddy and make flash cards with the equation on one side and answer on the other side for any that you do not know automatically. Use your flash cards to practice the multiplication facts that you do not know.

Curriculum Links

During Year 7

Identify, read, write, compare, and order whole numbers using powers of 10

Use rounding and estimation to predict results and to check the reasonableness of calculations

Recall multiplication facts to at least 10 × 10 and identify and describe the divisibility rules for 2, 3, 5, 9, and 10

Multiply whole numbers

During Year 8

Identify, read, write, compare, and order whole numbers and decimals using powers of 10

Use rounding, estimation, and benchmarks to predict results and to check the reasonableness of calculations

Anticipations

Solutions, Misconceptions

Task 2

The Salvation Army has donated $3213 to help families get essential furniture to set up their homes. They have 56 families that need help to do this. How much money will each family receive?

What numbers (above a thousand) could you start with, that would mean that each family only receives dollars and no cents?

Teacher Notes

Before the launch give students a completed grid for the 1 to 10 times-tables, ask them to highlight the facts which they don't need to learn due to the commutative property - these should be a triangle on the right side of the grid. Then ask them to highlight the 1s, 2s, 5s, and 10s, that should leave 21 facts to learn. Highlight that you are going to target the 6 remaining square numbers first (3 x 3, 4 x 4, 6 x 6, 7 x 7, 8 x 8, 9 x 9)... write the equation and answer on the board and ask students to make flash cards for these facts if they do not know them automatically to practice during the independent maths activity.
Prior to launching the task, ask students to calculate the following problems:

86 ÷ 21 =
866 ÷ 211 =
675 ÷ 225 =
$\frac{1}{2} \div \frac{1}{4} =$

Ask students to discuss what they notice.
Notice students who are using addition or subtraction and support them to re-work as multiplicative thinking.

Notice students who use doubling and support them to recognise this as multiplying by two. Press students to use larger factors such as 5 or 10.

Shareback

Select student solution strategies where they have used the inverse relationship of multiplication and division or the partial quotient/distributive property (or a mixture of both) in the solution. If either solution strategy has not been used, introduce this as a solution strategy that students have used previously.

Inverse relationship
3213 ÷ 56 = ?
56 x ? = 3213
56 x 10 = 560 ....

Big Ideas

There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship.

Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.

Patterns and relationships can be used, represented, and generalised in a variety of ways.

Shareback continued

Partial quotient/Distributive property
3213 ÷ 56 = (1120 ÷ 56) + (1120 ÷ 56) + (560 ÷ 56) + (112 ÷ 56) + (112÷ 56) + (112 ÷ 56) + (77 ÷ 56)

Connect

Ask students to describe how you would solve the following equation using either the inverse relationship or the partial quotient/distributive property:

7187 ÷ 35 =

Suggested Learning Outcomes

Explain and justify the use of the partial quotients/distributive property in division.

Explain and represent the inverse relationship of multiplication and division.

Represent reasoning using different forms of notation.

Independent Tasks

Solve the following equations:

836 x 261 =
319 x 672 =
467 x 789 =
876 x 208 =

Represent your solution strategies using equations and the area model.

Use your flash cards with a buddy and for any multiplication facts that you do not know automatically, write them out and say out loud quietly to yourself at least 4 times.

Curriculum Links

During Year 7
Recall multiplication facts to at least 10 × 10 and identify and describe the divisibility rules for 2, 3, 5, 9, and 10

Multiply and divide numbers by 10, 100, and 1,000

Divide whole numbers by one- or two-digit divisors (e.g., 327 ÷ 5 = 65.4 or 65 ⅘)

During Year 8
Identify and describe the divisibility rules for 2–11

Mathematical Language

Distributive property, inverse relationship, equivalence, factor, product, quotient, divisor, dividend.

Anticipations

Solutions, Misconceptions

Task 3

Griffin biscuit factory use a machine to put 203 biscuit packets in a large container to be sent for packaging. Every ten minutes the machine sorts 4519 packets of biscuits. How many containers would be used every ten minutes and how many packets of biscuits would be left over?

For what numbers would there be no packets of biscuits left over but almost the same number of containers used?

Teacher Notes

Before you launch the task write up the following string. Ask the students to solve each equation before writing the next one:

3 x 3 =
3 x 3 + 3 x 3 =
6 x 6 =
6 x 3 =

4 x 4 =
4 x 4 + 4 x 4 =
8 x 8 =
4 x 8 =

Ask them to discuss the patterns that they notice and highlight that if they know 3 x 3 or 6 x 6 then 6 x 3 is either double 3 x 3 or half 6 x 6 and similarly if they know 4 x 4 or 8 x 8 then 4 x 8 is double 4 x 4 or half 8 x 8

Prior to launching the task, ask students to calculate the following problems:

77 ÷ 31 =
777 ÷ 311 =

$$\frac{1}{3} \div \frac{1}{6} =$$

Ask students to discuss what they notice.
Notice students who are using addition or subtraction and support them to re-work as multiplicative thinking.

Notice students who use the inverse property or who are using partial quotients/distributive property in their calculations.

Big Ideas

There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship.

During Year 7
Recall multiplication facts to at least 10 × 10 and identify and describe the divisibility rules for 2, 3, 5, 9, and 10

Multiply and divide numbers by 10, 100, and 1,000

Divide whole numbers by one- or two-digit divisors (e.g., 327 ÷ 5 = 65.4 or 65 ⅖)

During Year 8
Identify and describe the divisibility rules for 2–11

Shareback

Select student solution strategies where they have used the partial quotient/distributive property in the solution.

Connect

Ask students to describe how you would solve the following equation using partial quotients/distributive property:

6716 ÷ 307 =

Use modelling to show connections between the use of the partial quotients/distributive property and the standard division algorithm.

Suggested Learning Outcomes

Explain and justify the use of the partial quotients/distributive property in division.

Explain and represent the inverse relationship of multiplication and division.

Represent reasoning using different forms of notation.

Independent Tasks

Solve the following equations:

5556 ÷ 25 =

8666 ÷ 422 =

7255 ÷ 35 =

9333 ÷ 322 =

$\frac{1}{4} \div \frac{1}{8} =$

$\frac{1}{2} \div \frac{1}{5} =$

Use your flash cards for 3 x 3, 6 x 6, 4 x 4, 8 x 8. Make new flash cards for 6 x 3 and 4 x 8 and practice these while also noting the relationship between the square numbers and the new facts.

Mathematical Language

Distributive property, inverse relationship, equivalence, factor, product, quotient, divisor, dividend.

Anticipations

Solutions, Misconceptions

Task 4

Work in your group to see whether you can work out the last digits of the following numbers without doing the full multiplication:

5^4
6^4
7^4

Discuss the patterns that you could use to help you with the task. Develop a range of conjectures and see whether you can prove them.

Teacher Notes

Before the launch give students a grid for the 1 to 10 times-tables and ask students to solve them and record their time (in a non-public way). http://www.mental-arithmetic.co.uk/multiplication-grids-pdf-generator.htm
The goal is to complete the grid in under 5 minutes so stop at 5 minutes. Get the students to record their time OR how much they have completed. Ask them to check whether they have improved their time or how much they completed.

Prior to launching the task, ask students to work with a partner and record equations for square numbers.

$1^2 = 1 \times 1 = 1$
$2^2 = 2 \times 2 = 4$ ....

Ask the students to identify the patterns that they notice. Provide students with access to squared paper to draw representations.

Provide students with access to calculators to help them work on the task.

Encourage students to use smaller numbers or draw models to prove that their conjectures work.

Shareback

Select and sequence student solutions which identify patterns and ask students to explain and justify these.

1, 5 and 6 are special cases of exponents as they will always end with the same digit.

Exponents of 2, 3, 4, 7, 8, 9 each have a set pattern/cycle for the last digit.

Big Ideas

Relationships can be described and generalisations made for mathematical situations that have numbers or objects that repeat in predictable ways.

Curriculum Links

During Year 7

Use exponents to represent repeated multiplication, and identify square roots of square numbers up to at least 100

Use rounding and estimation to predict results and to check the reasonableness of calculations

During Year 8

Identify and describe the properties of prime and composite numbers up to at least 100 and cube numbers up to at least 125

Use rounding, estimation, and benchmarks to predict results and to check the reasonableness of calculations

Connect

Can you work out what the last digit would be for 7^5 without doing the full multiplication?

Through discussion draw out that in last digit patterns, some numbers are special and only have the same number they were multiplied by, some have 2 numbers, and the others have a combination of 4 numbers.

Notice students using conjecture or proof that 5 x 5 always ends with a 5 so therefore it continues always with a 5 in the ones digit.

Suggested Learning Outcomes

Identify that a power is represented by a base number and an exponent and that a power is the product of multiplying a number by itself.

Calculate powers of numbers.

Explain and justify patterns and relationships in powers of numbers.

Independent Tasks

Work to see whether you can work out the last digits of the following numbers without doing the full multiplication:

2^8
8^4
9^6
10^5

What patterns can you use that will help you with this task?
Predict the results and write these down with a justification.
Now use a calculator to check whether you were correct.
What conjectures can you make from this?

Mathematical Language

Power, base number, exponent, product, digit, conjecture.

Anticipations

Solutions, Misconceptions

Task 5

Can you work together in your group to work out whether these number sentences are true or false?
Make sure that you develop an explanation that everyone can share.

398 + 467 = 396 + 469
657 + 18 = 657 + 9 + 8
82 – 34 = 84 – 36
465 = 465
8 × 7 = (8 × 5) + 8
9 × 7 = (10 × 7) – 7
25 + 26 + 27 + 28 + 29 + 30 = 31 + 32 + 33 + 34 + 35

Teacher Notes

Before you launch the task write up the following equations:

6 x 6 =
Model that 6 x 6 can be written as (2 x 3) x (2 x 3)
Ask students to discuss what they notice and highlight that 2 x 3 are factors of 6 connecting to previous work.
Record (2 x 2) x (3 x 3) = 4 x 9
Ask them to discuss the patterns that they notice and make a connect to 6 x 6 = 36 and 4 x 9 = 36.

Ensure that students understand what true and false means. Introduce notation of not equal (≠) for the number sentences that they think are false.

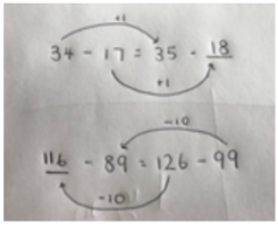
Students may initially treat the equals sign as an operator or indication to write the answer next. These misconceptions can be used to position students to engage in mathematical argumentation.

Students also may compute each side to work out whether they are equal.

Notice students who use the relationships across the equals sign to see whether there is balance.

Highlight the students' relational responses (e.g., noticing the + 2, – 2 relationships).

Press for use of arrows and notations to highlight the relationships.



Big Ideas

Equations show relationships of equality between parts on either side of the equal sign.

The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other

Shareback

Select student solution strategies that use relational reasoning.

82 – 34 = 84 – 36 is true because 84 is two more than 82 and 36 is two more than 34.

Connect

Can you work out whether the following are true or false without calculating each side?

353 – 328 = 53 – 28

227 + 378 = 217 + 398

Suggested Learning Outcomes

Explain and justify relationships between numbers in an equation.

Write statements of equivalence in words and using notation.

Solve equivalence problems and explain and justify the solutions.

Independent Tasks

Work out which number sentences are true or false and explain your reasoning.

369 + 496 = 367 + 494
267 + 7 + 9 = 267 + 16
71 – 57 = 73 – 59
459 = 455
6 × 7 = (6 × 5) + 7 + 7
13 × 8 = (13 × 5) + (13 × 2)
4 + 5 + 6 + 7 = 8 + 9 + 10

Curriculum Links

During Year 7
Identify, read, write, compare, and order whole numbers using powers of 10 (e.g.10,000 = 104)

Use rounding and estimation to predict results and to check the reasonableness of calculations
Use the order of operations

Form and solve one-step linear equations (e.g., t + 7 = 12, 2s = 14)

During Year 8
Identify, read, write, compare, and order whole numbers and decimals using powers of 10 (e.g., 0.01 = 1/100 = 10-2)

Use rounding, estimation, and benchmarks to predict results and to check the reasonableness of calculations
Use the order of operations

Form and solve one- or two-step linear equations (e.g., 5s + 3 = 18).

Mathematical Language

Equivalent, equal sign.

Anticipations

Solutions, Misconceptions

Task 6

Can you work together in your group to solve these number sentences? Make sure that you develop an explanation and justification.

189 + 25 = _ + 26

85 – _ = 75 – 28

674 + 56 – _ = 671

24 × 16 = 48 × _

105 ÷ 15 = (45 ÷ 15) + (_ ÷ 15)

Teacher Notes

Before you launch the task write up the following string of equations. Ask the students to solve each one before writing up the next and ask them to discuss and identify the patterns they notice:

3 x 4 =
3 x 8 =
6 x 4 =
6 x 8 =

Ask students to discuss what they notice and highlight the multiplicative relationship of times two (or doubling between each one) that they can use to learn their multiplication facts. Highlight that for the last one, they could use 3 x 4 = 12 and double that twice because 3 x 2 = 6 and 4 x 2 = 8.

Students may initially treat the equals sign as an operator or indication to write the answer next.

Students also may compute each side to work out whether they are equal. Notice students who use the relationships across the equals sign to see whether there is balance.

Highlight to the students to look across the equals sign and find the relationships between numbers to the left and the numbers on the right. Notice students who use the relationships across the equals sign to see whether there is balance.

Highlight the students relational responses (e.g., noticing the + 2 – 2 relationships).

Press for use of arrows and notations to highlight the relationships.

Big Ideas

Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.

Shareback

Select student solution strategies that use relational reasoning.

Connect

Ask students to generate conjectures related to the equivalence problems that build on the properties of equality.

Suggested Learning Outcomes

Explain and justify relationships between numbers in an equation.

Write statements of equivalence in words and using notation.

Solve equivalence problems and explain and justify the solutions.

Independent Tasks

Find the missing numbers:

37 + 26 = 35 + ___

__ + 276 = 399 +286

376 – 159 = 276 – _ =

_ – 266 = 571 – 268

3 × 18 = (3 × 6) + (3 × _)

176 ÷ 8 = (_ ÷ 8) + (16 ÷ 8)

Look at your flash cards for or write them out if you don't have them.

3 x 4 =
3 x 8 =
6 x 4 =
6 x 8 =

Discuss with a partner the patterns that you notice between each one. Use the patterns to help remember the times-table facts.

Curriculum Links

During Year 7
Identify, read, write, compare, and order whole numbers using powers of 10 (e.g., 10,000 = 104)

Use rounding and estimation to predict results and to check the reasonableness of calculations
Multiply whole numbers
Use the order of operations

Form and solve one-step linear equations (e.g., t + 7 = 12, 2s = 14)

During Year 8
Identify, read, write, compare, and order whole numbers and decimals using powers of 10 (e.g., 0.01 = 1/100 = 10-2)

Use rounding, estimation, and benchmarks to predict results and to check the reasonableness of calculations
Use the order of operations

Form and solve one- or two-step linear equations (e.g., 5s + 3 = 18)

Mathematical Language

Equivalent, equal sign.

Anticipations

Solutions, Misconceptions

Task 7

What are the possible values for k + k = 12?

What are possible values for j + s = 10?

Now, work together in your group to solve these equations and justify your solution. Make sure that everyone can explain and justify your responses.
w + 14 = 30
2b + 5 = 23
6h – 7 = 29
d + d – 5 = 13
3p + p + 2 – p = 17

Teacher Notes

Before you launch the task write up the following string of equations. Ask the students to solve each one before writing up the next and ask them to discuss and identify the patterns they notice:
3 x 7 =
6 x 7 =
9 x 7 =
Ask students to discuss what they notice and highlight the multiplicative relationship of times two (or doubling between each one) and times 3 between the first and last equation that they can use to learn their multiplication facts. Highlight that for the last one, they could use 3 x 7 = 21 and triple it for 9 x 7 = 63.

Before you launch the problem, ask the students to work with a partner and write an expression to match these situations:
a) I have some lollies and I get five more.
b) I have some lollies and I get five more and then I get three more.
c) I have some lollies and I give six away.
c) I have some lollies and I get five more and then I double the total amount of lollies I have.
Introduce each one and share student solutions that use a variable to model the equation. If all students put numbers, then problematise this by asking, do we know how many? If we don't know, we can use a letter to represent any number.
Introduce to students that 2n = 2 x n

Launch the first part of the problem and then bring the students back to share ideas. Highlight that k will be the same number so only one solution. Address potential misconception that j and s cannot both equal 5. Highlight that j + s has multiple solutions including j = 5 s = 5

Values of variables: Variables can have any values - a letter is assigned to this value. The same variable has the same value in an equation. Different variables can have the same value.

Big Ideas

Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.

Teacher notes continued

Discuss and explore with the students that equations remain balanced as long as you use the properties of equality. An operation conducted on one side of the equal sign must be applied on the other. Apply the inverse of an operation to cancel it out or remove it. The goal in solving linear equations is to isolate the unknown variable by applying the inverse to remove other known variables.

Shareback

Select student solution strategies that use inverse relationships and the properties of equality.

Connect

The solution to $2n + 15 = 31$ is $n = 8$.
What is the solution to $2n + 15 - 9 = 31 - 9$?

What conjecture can you make from this?

Conjecture could be represented as:
If $a + b = c$ then $a + b - d = c - d$
or
If $a + b = c$ then $a + b + d = c + d$

Suggested Learning Outcomes

Explain and justify how when the value of one variable is known the value of the other variable can be found by solving the equation.

Use inverse relationships and understanding of properties of equality to solve equations.

Independent Tasks

Solve the following equations:

$5g = 35$
$d + 7 = 16$
$k - 9 = 31$
$n \div 4 = 3$
$3b + 4 = 28$
$10x - 14 = 26$
$8j + 7 = 39$
$3e - 8 = 28$

Curriculum Links

During Year 7

Form and solve one-step linear equations (e.g., $t + 7 = 12$, $2s = 14$)

During Year 8

Form and solve one- or two-step linear equations (e.g., $5s + 3 = 18$)

Mathematical Language

Unknown, variable, inverse relationships, equivalence, equation, values

Anticipations

Solutions, Misconceptions

Task 8

Work together in your group to solve these equations and justify your solution. Make sure that everyone can explain and justify your responses.

$6q = 2q + 24$
$2s + 5s = 15 + 13$
$16 = 4 - t + 3t$
$15 + p = 2p - 3$
$7y - 13 = 2y + 12$

Teacher Notes

Before you launch the task write up the following string of equations. Ask the students to solve each one before writing up the next and ask them to discuss and identify the patterns they notice:
2 x 7 =
4 x 7 =
8 x 7 =

3 x 9 =
6 x 9 =
Ask students to discuss what they notice and highlight the multiplicative relationship of times two (or doubling between each one) a that they can use to learn their multiplication facts.

Before you launch the task, revisit the conjectures made in the previous lesson that established that equations remain balanced as long as you do the same thing to both sides.

Ask the students: What value would make the following equation true?

$j + j = j + 6$

Is $b + f + n = b + e + n$ always, sometimes, or never true?

Highlight that the same variable has the same value in an equation but different variables can have the same value.

Discuss and explore with the students that equations will remain balanced as long as you use the properties of equality. An operation conducted on one side of the equal sign must be applied on the other. Apply the inverse of an operation to cancel it out or remove it. The goal in solving linear equations is to isolate the unknown variable by applying the inverse to remove other known variables.

Big Ideas

Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.

A solution to an equation is a value of the unknown or unknowns that makes the equation true. Properties of equality and the inverse property can be used to generate equivalent equations and find solutions.

Shareback

Select student solution strategies that use inverse relationships and the properties of equality to isolate and solve for the unknown.

Connect

Ask students to describe the steps that you could take to solve the following:

$4a + 6 = 9a - 9$

Suggested Learning Outcomes

Explain and justify how when the value of one variable is known the value of the other variable can be found by solving the equation.

Use inverse relationships and understanding of properties of equality to solve equations.

Independent Tasks

Solve the following equations:

$x + 11 = 40$
$23 - h = 15$
$8e = 80$
$6h - 5 = 7$
$1 + 2r = 35$
$8q + 8 = 2q + 62$
$3h + 4 = h + 16$
$6w - 8 = 13 + 3w$

Look at your flash cards for or write them out if you don't have them.

2 x 7 =
4 x 7 =
8 x 7 =

3 x 9 =
6 x 9 =

Discuss with a partner the patterns that you notice between each one. Use the patterns to help remember the times-table facts.

Curriculum Links

During Year 7

Form and solve one-step linear equations (e.g., t + 7 = 12, 2s = 14)

During Year 8

Form and solve one- or two-step linear equations (e.g., 5s + 3 = 18)

Mathematical Language

Unknown, variable, inverse relationships, equivalence, equation, values.

Anticipations

Solutions, Misconceptions

Task 9

In your groups look at the equations and develop a story that matches the equation. Make sure that everyone in your group can explain and justify why the story matches the equation. Have a go at solving the story problems that you have created:

5 + _ = 21

-5 – 3 =

_ – -15 = -7

Teacher Notes

Before you launch the task, ask students to brainstorm everything that they know about negative numbers and record their ideas.

Integers are an extension of whole numbers which include positive and negative whole numbers that are opposites (...-2, -1, 0, 1, 2,...).

Possible story contexts: height above sea level, scoring in sports/games e.g. golf, Bridge, positive/negative spaces e.g. digging holes, lifts which go below ground, temperatures below zero.

Shareback

Select student solution strategies that use inverse relationships and the properties of equality to isolate and solve for the unknown.

Connect

Ask students to compare the stories and notice similarities and differences.

Suggested Learning Outcomes

Represent in a mathematical story a situation in a problem which has both negative and positive numbers.

Explain and justify how integers are an extension of whole numbers and include both positive and negative whole numbers.

Big Ideas

Mathematical situations can be represented as equations which include both positive and negative integers.

A real quantity having a value less than zero is negative. Positive and negative numbers are opposites.

Curriculum Links

During Year 7

Order, compare, and locate integers on a number line, and explore adding and subtracting integers

During Year 8

Order, compare, add, and subtract integers

Independent Tasks

Look at the equations and develop one or more stories that match each equation.

4 + -5 =
- 13 – _ = 0
_ + 32 = - 31
22 – -14 =

Mathematical Language

Integers, negative number, positive number.

Anticipations

Solutions, Misconceptions

Task 10

In your groups represent your reasoning on a number line to show how you solved each of these problems:

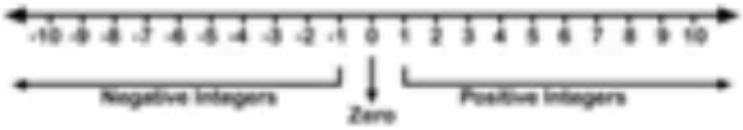
3 + 4 =
12 – 17 =
4 + -4 =
2 + -5 =
3 – -5 =
-9 + -8 =

Teacher Notes

Before the launch give students a grid for the 1 to 10 times-tables and ask students to solve them and record their time (in a non-public way).
http://www.mental-arithmetic.co.uk/multiplication-grids-pdf-generator.htm

The goal is to complete the grid in under 5 minutes so stop at 5 minutes. Get them to record their time OR how much they have completed. Ask them to check whether they have improved on their time or how much they have completed.

Before you launch the task, ask students to share when they see negative numbers in life?
[Lifts, mortgages, temperature]
Model an empty number line on the board and ask students to discuss where the numbers would go if you were counting from negative 5 to positive 5. Use the number line to represent the location/relationship of negative/positive numbers to each other.



Highlight that two integers that are the same distance from the origin in opposite directions are called opposites and when added cancel each other making 0.
Highlight difference between the use of - as an operation symbol (subtraction) and direction symbol (direction/size of movement) for negative numbers.
Consider using physical materials to represent positive and negative numbers e.g. black counters (positive) and red counters (negative).

Big Ideas

Mathematical situations can be represented as equations which include both positive and negative integers.

A real quantity having a value less than zero is negative. Positive and negative numbers are opposites.

Curriculum Links

During Year 7

Order, compare, and locate integers on a number line, and explore adding and subtracting integers

During Year 8

Order, compare, add, and subtract integers

Shareback

Select student solution strategies that will support a discussion of the relationship between addition and subtraction when working with integers.

Connect

What patterns did you notice when you were adding and subtracting positive and negative numbers?

Suggested Learning Outcomes

Solve simple addition and subtraction equations using integers.

Use a number line to represent the relationship between positive and negative integers in equations.

Explain and justify the role of zero as neither positive nor negative.

Explain and justify the use of - as an operation symbol (subtraction) and direction symbol (direction/size of movement) for negative numbers.

Independent Tasks

Solve these equations (use a blank number line if it helps):

-18 + 5 =
- 23 + - 18 =
-37 – -42 =
63 – -24 =
-143 – 69=
-145 + -251 =
274 – -128 =

Mathematical Language

Integers, negative number, positive number.

Anticipations

Solutions, Misconceptions

Task 11

Soane is solving a division problem that his teacher gave him.

He is solving this: 216 ÷ 12 =

Soane solves it by writing 216 ÷ 12 = 216 ÷ 2 ÷ 3 ÷ 2

Do you agree with Soane's solution? In your group, develop an explanation of why this works or why you think it doesn't work.

Can you develop examples with other numbers which also use this pattern?

Does this pattern work with multiplication?

Teacher Notes

Facilitate students to focus on the solution strategy and generalisation rather than calculating the solution.

Notice and highlight the conjectures that students develop.

Shareback

Select students who use the relationship and properties rather than calculating.

Highlight to the students that you do not need to calculate but can use the relationship to solve different equations.

Connect

Elise thought that Soane should have solved the problem like this:

216 ÷ 12 = (216 ÷ 2) + (216 ÷ 3) + (216 ÷ 2)

Do you agree with Elise?

Which way works and why?

How would Soane solve the following problem 438 ÷ 16?

Big Ideas

There are arithmetic properties that characterise addition and multiplication as operations. These are the commutative, associative, distributive, and identity properties. Addition and subtraction and multiplication and division have an inverse relationship

.

Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other.

Patterns and relationships can be used, represented, and generalised in a variety of ways.

Suggested Learning Outcomes

Explain and justify how you can solve division problems by splitting the divisor into factors.

Represent that the equals sign as a statement of balance and show which operations to both sides of an equation preserve that balance.

Independent Tasks

Find the missing numbers:

46 x _ = 46 x 3 x 5 x 2
1392 ÷ 3 ÷ 2 ÷ 2 ÷ _ = 1392 ÷ 24
1260 ÷ _ = 1260 ÷ 2 ÷ 5 ÷ 3 ÷ 2
27 x 36 = 27 x 3 x _ x 4

Curriculum Links

During Year 7

Use rounding and estimation to predict results and to check the reasonableness of calculations

Recall multiplication facts to at least 10 × 10 and identify and describe the divisibility rules for 2, 3, 5, 9, and 10

Use the order of operations

Divide whole numbers by one- or two-digit divisors (e.g., 327 ÷ 5 = 65.4 or 65 ⅖)

During Year 8

Identify and describe the divisibility rules for 2–11

Use rounding, estimation, and benchmarks to predict results and to check the reasonableness of calculations

Use the order of operations

Divide whole numbers (e.g., 327 ÷ 15 = 21.8 or 21 ⅘)

Mathematical Language

Factors, divisor, dividend, associative property.

Anticipations

Solutions, Misconceptions

Task 12

Can you work together in your group to work out whether these number sentences are true or false? Make sure that you develop an explanation that everyone can share.

8 + 3 = -8 – 3
7 + 5 = 7 + -5
-3 + 6 = 6 + -3
10 – 4 = 10 – -4
-7 + - 9 = -7 – -9
- 5 – -5 = -5 – -1

In your group, talk about the patterns that you notice and be ready to share these.

Teacher Notes

Notice student solution strategies that use the properties of equality.

Highlight the difference between the use of - as an operation symbol (subtraction) and direction symbol (direction/size of movement) for negative numbers.

Shareback

Select student solution strategies that use the properties of equality and understanding of negative numbers.

Connect

What conjectures can you make that will always work about adding and subtracting negative and positive numbers?

Suggested Learning Outcomes

Solve simple addition and subtraction equations using integers.
Use a number line to represent the relationship between positive and negative integers in equations.

Explain, justify and represent reasoning related to maintaining equality between operations which involve integers.

Big Ideas

Equations show relationships of equality between parts on either side of the equal sign. The properties of equality are: If the same real number is added or subtracted to both sides of an equation, equality is maintained; If both sides of an equation are multiplied or divided by the same real number (not dividing by 0), equality is maintained; Two quantities equal to the same third quantity are equal to each other. Mathematical situations can be represented as equations which include both positive and negative integers. A real quantity having a value less than zero is negative. Positive and negative numbers are opposites.

Independent Tasks

Select One of the following assessment tasks as the independent activity.

Task 1 - Multiplication and Division
Task 2 - Multiplication and Division
Task 3 - Properties of Numbers and Operations
Task 4 - Properties of Numbers and Operations
Task 5 - Integers and Negative Numbers
Task 6 - Integers and Negative Numbers

Curriculum Links

During Year 7
Use rounding and estimation to predict results and to check the reasonableness of calculations

Order, compare, and locate integers on a number line, and explore adding and subtracting integers

During Year 8
Use rounding, estimation, and benchmarks to predict results and to check the reasonableness of calculations

Order, compare, add, and subtract integers

Mathematical Language

Integers, negative number, positive number.

Anticipations

Solutions, Misconceptions

Assessment Task 1 - Number and Algebra - Year 7-8

At the event centre, there are 225 rows of seats. Each row has 179 seats in it. How many seats are there altogether?

The library is moving. They have 3248 books and can fit 76 books into each box. How many boxes will be needed for the books?

Write your own multiplication or division problems. Show how you would solve them.

Assessment Task 2 - Number and Algebra - Year 7-8

At the shopping mall, there are 124 rows for carparks. Each row has spaces for 288 cars. How many carparks are there altogether?

A school is going on a trip and there are 1642 people who need transport. Each bus can take 38 people. How many buses will be needed?

Write your own multiplication or division problems. Show how you would solve them.

Assessment Task 3 - Number and Algebra - Year 7-8

76×15 $37 + 43 + 40 + 36$ $99 \div 3 \div 3$

7×86 4×66 6^3

$99 \div 9$ $(70 \times 5) + (70 \times 10) + (6 \times 10) + (6 \times 5)$ 12×22

$37 + 40 + 36 + 43$ $6 \times 6 \times 6$ $(7 \times 90) - (7 \times 4)$

Look at the number sentences above.
Describe what patterns you can find.
Why do your patterns work?

Do they work with other numbers?
Will they always work? Explain and justify your thinking

Assessment Task 4 - Number and Algebra - Year 7-8

84 x 16 56 + 79 + 44 + 38 88 ÷ 2 ÷ 2

6 x 47 3 x 99 54

88 ÷ 4 (80 x 10) + (80 x 6) + (4 x 10) + (4 x 6) 9 x 33

38 + 56 + 79 + 44 5 x 5 x 5 x 5 (6 x 50) − (6 x 3)

Look at the number sentences above.

Describe what patterns you can find.

Why do your patterns work?
Do they work with other numbers?
Will they always work? Explain and justify your thinking

Assessment Task 5 - Number and Algebra - Year 7-8

Why do we need negative numbers?

Give examples of how negative numbers can be useful.

Assessment Task 6 - Number and Algebra - Year 7-8

Write a story that matches the equation.
Solve the story problem.

-16 + 20 =

15 − _ = 18

- 12 + - 6 =

_ − -9 = -11

-7 + _ = 10

-2 − 9 =