Year 9 Home Learning
Summer term 2020

Student workbook

Name ...........................................................................................................

School ...........................................................................................................

Teacher ...........................................................................................................
# Learning schedule for Summer term 1

<table>
<thead>
<tr>
<th>W/B</th>
<th>Revision of key topics already covered in Year 9</th>
<th>Pg.</th>
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<tbody>
<tr>
<td>27 Apr</td>
<td>Plotting straight line graphs</td>
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<td>Gradient of a line</td>
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<td>4 May</td>
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<td>Unitary method</td>
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<td>11 May</td>
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<td>Converting between ordinary numbers and standard form</td>
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<td>Expanding single brackets</td>
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<td>Numeracy Ninjas: Skills Challenge 4</td>
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</table>

If you are looking for some maths to do over the half term break, take a look at the following websites for tasks that will keep you busy with some fun activities:

- [https://mathigon.org/origami](https://mathigon.org/origami)
- [https://nrich.maths.org](https://nrich.maths.org)
- [https://www.cipherchallenge.org](https://www.cipherchallenge.org)
# Learning schedule for Summer term 2

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<td>15 Jun</td>
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<td>Interior and exterior angles in polygons</td>
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<td></td>
<td>Numeracy Ninjas: Skills Challenge 11</td>
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Introduction

What is included in this home learning pack?

It is not easy to learn at home without the support from your teacher that you are used to. This means that this pack includes some topics that you have already covered in Year 9 so that you get a chance to go back over them and remember them. It also includes some new topics that you would have been taught in the spring and summer terms. This new content is not everything and the topics have been chosen carefully as ones we think you can study on your own at home with the help of the resources in this pack.

How should I use this pack effectively?

You should make sure that you use the video tutorials for each topic to ensure you have fully understood the topic. This should then be followed by completing the practice questions and attempting the ‘extend’ questions to really make you think. Mark your own mark using the answers to check you are on the right track. To finish, complete the progress check quizzes on Hegarty Maths to show your teacher that you are understanding the topics. They will be keeping an eye on your progress over the summer term.

How is this booklet structured?

| Key points | Precise bullet points which outline the key knowledge you need to know in each topic |
| Examples – Video tutorials | Videos that explain each topic and go through key examples |
| Practice | A series of questions to give you the opportunity to practice and demonstrate you have understand the topic fully |
| Extend | Some more challenging and stretching questions to make you think a little bit more. Rise to the challenge and have a go at these questions! |
| Answers | A full set of answers for the practice questions so that you can check your work and assess your progress as you work through the booklet |
| Progress check | Quizzes on Hegarty Maths to show your teacher that you have understood the topic fully |

Weekly skills check

Each week, you will have one lessons which provides you with a timed challenge. This is based around numeracy and general mathematical skills which we would expect all Year 9 students to be confident with. You should time yourself and see if you can improve your time each week.
Plotting straight line graphs

Key points

- A straight-line graph can also be referred to as a **linear** graph.
- A linear graph has a **constant gradient**. It can be positive or negative, depending on which way the line is sloping.
- To plot a straight-line graph, you need a linear function, which is usually in the form of $y = mx + c$. For example, $3x + 2$ or $0.5x - 1$.
- We use a **table of values** to help us in plotting in the coordinates that form our straight-line graph.
- We should use a **ruler** when connecting the coordinates to form an accurate straight-line graph.

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Drawing linear graphs

**Scan the QR code above with your mobile phone**

*or click on the QR code to follow the hyperlink*
Practice

Question 1: For each equation, complete the table of values and draw its graph for values of $x$ from $-1$ to $3$.

(a) $y = 2x + 1$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$-1$</th>
<th>$0$</th>
<th>$1$</th>
<th>$2$</th>
<th>$3$</th>
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</thead>
<tbody>
<tr>
<td>$y$</td>
<td>$-1$</td>
<td>$1$</td>
<td></td>
<td></td>
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</table>

(b) $y = 3x - 1$

<table>
<thead>
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<th>$-1$</th>
<th>$0$</th>
<th>$1$</th>
<th>$2$</th>
<th>$3$</th>
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<tr>
<td>$y$</td>
<td>$-4$</td>
<td>$5$</td>
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(c) $y = 2x - 3$

<table>
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<tr>
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<td>$-3$</td>
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(d) $y = x + 4$

<table>
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<th>$0$</th>
<th>$1$</th>
<th>$2$</th>
<th>$3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
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</table>

(e) $y = 2x$

<table>
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<th>$1$</th>
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<th>$3$</th>
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</thead>
<tbody>
<tr>
<td>$y$</td>
<td>$0$</td>
<td>$6$</td>
<td></td>
<td></td>
<td></td>
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</table>

Question 3: For each equation, complete the table of values and draw its graph for values of $x$ from $-2$ to $2$.

(a) $y = 3x + 3$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$-2$</th>
<th>$-1$</th>
<th>$0$</th>
<th>$1$</th>
<th>$2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
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</table>

(b) $y = x + 9$

<table>
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<tr>
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<th>$-1$</th>
<th>$0$</th>
<th>$1$</th>
<th>$2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
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</table>

(c) $y = x - 2$

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<th>$-1$</th>
<th>$0$</th>
<th>$1$</th>
<th>$2$</th>
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<tbody>
<tr>
<td>$y$</td>
<td></td>
<td></td>
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</table>

(d) $y = x$

<table>
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<tr>
<th>$x$</th>
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<th>$-1$</th>
<th>$0$</th>
<th>$1$</th>
<th>$2$</th>
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</thead>
<tbody>
<tr>
<td>$y$</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Extend

Question 2:  (a) Draw \( y = 3x - 4 \)

(b) Draw \( x + y = 2 \)

The graph \( y = 3x - 4 \) crosses the y-axis at the point A
The graph \( x + y = 2 \) crosses the x-axis at the point B
O is the origin.

(c) Write down the coordinates of the point A

(d) Write down the coordinates of the point B

(e) Find the area of triangle OAB.

Answers

Question 1

(a) \( y = 2x + 1 \)

(b) \( y = 3x - 1 \)

(c) \( y = 2x - 3 \)

(d) \( y = x + 4 \)

(e) \( y = 2x \)
Question 3:
(a) \( y = 3x + 3 \)
(b) \( y = x + 9 \)
(c) \( y = x - 2 \)
(d) \( y = x \)

Question 2:
(a) + (b)
(c) (0, -4)
(d) (2, 0)
(e) 4
Progress check

You should now complete quiz number 206 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

Score: %

Date completed:
Gradient of a line

Key points

- The **gradient** of a line is its steepness.
- To calculate the gradient of a line, we need to consider **two coordinates** on the line.
- To calculate the gradient of a line: \( \text{Gradient} = \frac{\text{Change in } y}{\text{Change in } x} \)
- A line sloping from bottom left to top right has a **positive** gradient.
- A line sloping from top left to bottom right has a **negative** gradient.

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Gradient of a line

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Find the gradient of each of these lines
(a) \[ \text{Graph} \]
(b) \[ \text{Graph} \]
(c) \[ \text{Graph} \]
(d) \[ \text{Graph} \]
(e) \[ \text{Graph} \]
(f) \[ \text{Graph} \]

Question 3: Find the gradient of each of these lines
(a) \[ \text{Graph} \]
(b) \[ \text{Graph} \]
(c) \[ \text{Graph} \]
(d) \[ \text{Graph} \]
(e) \[ \text{Graph} \]
(f) \[ \text{Graph} \]
Question 6: Find the gradient of each line shown below

(a) \[ y \]
(b) \[ y \]
(c) \[ y \]

Question 7: Work out the gradient of the line passing through these pairs of points
(a) (1, 4) and (3, 10)  
(b) (0, 0) and (3, 12)  
(c) (5, -2) and (9, 14)

Extend

Question 5: The line passing through (3, -4) and (m, 10) has a gradient of 2.
Find m.

Question 6: The line passing through (-2, 5) and (2, n) has a gradient of \(-\frac{1}{2}\)
Find n.

Answers

Question 1:
(a) 2  
(b) 1  
(c) 3  
(d) \(\frac{1}{2}\)  
(e) 5  
(f) -2

Question 3:
(a) \(\frac{1}{2}\)  
(b) \(\frac{3}{4}\)  
(c) \(-\frac{2}{3}\)

(d) \(\frac{3}{4}\)  
(e) \(-\frac{2}{5}\)  
(f) \(-1\frac{1}{3}\)

Question 6:
(a) 2  
(b) 4  
(c) 1

Question 7:
(a) 3  
(b) 4  
(c) 4

Question 5: m = 10
Question 6: n = 3
Progress check

You should now complete quiz numbers 201 and 202 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

**Quiz 201**

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**Quiz 202**

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<th>Date completed:</th>
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Skills challenge 1
(Numeracy Ninjas)

Instructions

• Complete the 30 questions below. You have **20 minutes maximum**.
• Time yourself. See how long it takes you to complete all of the questions.
• Ask your parent or sibling to check your answers when you are finished.
• Record your score and time taken to complete all 30 questions below.

### MENTAL STRATEGIES – do these in your head

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<th>Question</th>
<th>Answer</th>
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<tr>
<td>1</td>
<td>$\Box + 2 = 5$</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$100 = 17 + \Box$</td>
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</tr>
<tr>
<td>3</td>
<td>What is half of 9?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$105 - 10 = \Box$</td>
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<tr>
<td>5</td>
<td>$62 + \Box = 70$</td>
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</tr>
<tr>
<td>6</td>
<td>$23 - 10 + \Box$</td>
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<tr>
<td>7</td>
<td>$9981 - 9979 = \Box$</td>
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<tr>
<td>8</td>
<td>$1 \times 5 = 5$, so $5 + 5 = \Box$</td>
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<tr>
<td>9</td>
<td>What is 16:21 in 12 hour clock format?</td>
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<tr>
<td>10</td>
<td>What time will it be 37 minutes after 20:25?</td>
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**Total out of 10**

### TIME TABLES – do these in your head

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<td>1</td>
<td>$\Box \times 7 = 14$</td>
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<td>2</td>
<td>$24 + 8 = \Box$</td>
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<td>3</td>
<td>$18 + \Box = 2$</td>
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<tr>
<td>4</td>
<td>$8 \times \Box = 48$</td>
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<tr>
<td>5</td>
<td>$\Box + 3 = 9$</td>
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<td>6</td>
<td>$\Box \times 9 = 90$</td>
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</tr>
<tr>
<td>7</td>
<td>$8 \times 10 = \Box$</td>
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</tr>
<tr>
<td>8</td>
<td>$3 \times \Box = 27$</td>
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</tr>
<tr>
<td>9</td>
<td>$4 \times 8 = \Box$</td>
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<tr>
<td>10</td>
<td>$\Box + 4 = 6$</td>
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**Total out of 10**

### KEY SKILLS – you may use written calculations for these questions

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<th>Answer</th>
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<tr>
<td>1</td>
<td>$838 \times 92 = \Box$</td>
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<tr>
<td>2</td>
<td>$6931 - 3947$</td>
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<td>3</td>
<td>$2.9 \times 6.22$</td>
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<tr>
<td>4</td>
<td>$62/100 = \Box %$</td>
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</tr>
<tr>
<td>5</td>
<td>$(\Box - 9) \times (\Box - 3)$</td>
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<td>6</td>
<td>Round 84.6193 to 1 decimal place</td>
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</tr>
<tr>
<td>7</td>
<td>$(\Box - 1) + (\Box - 2)$</td>
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</tr>
<tr>
<td>8</td>
<td>Round 545 to 1 s.f.</td>
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</tr>
<tr>
<td>9</td>
<td>What is the letter at $(-1,1)$?</td>
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<table>
<thead>
<tr>
<th>Letter</th>
<th>ABCDEFGHIJKLMNOPQRSTU VWXYZ</th>
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<td>y</td>
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<td>B</td>
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</tr>
<tr>
<td>10</td>
<td>What is 2/3 of 6?</td>
<td></td>
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</table>

**Total out of 10**

Score: / 30

Time taken: :
Key points

- A line segment is a line that starts and ends at fixed points, such as A ——— B, where A and B are known as end points of the line segment.
- The midpoint of a line segment is the point that is half-way along a line segment.
- When you know the coordinates of the end points of the line segment, you can use them to calculate the midpoint.
- You do this by finding the x-coordinate in each end point and calculating the mean average of them. You then calculate the mean average of the y-coordinates of the end points. The coordinates of the midpoint = (‘mean of x’, ‘mean of y’).
- This can be written as a formula that you can learn: if Point 1 has coordinates (x₁, y₁) and Point 2 has coordinates (x₂, y₂) then the midpoint is \(\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)\).
- For example, if the end points of the two coordinates are (-3, 8) and (7, 4) then the midpoint is \(\left(\frac{-3+7}{2}, \frac{8+4}{2}\right) = \left(\frac{4}{2}, \frac{12}{2}\right) = (2, 6)\).

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths video below

Midpoint of a line segment

Scan the QR code above using your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Find the coordinates of the midpoints of the following line segments:

(a) \( (2, 4) \) and \( (6, 10) \)  
(b) \( (1, 4) \) and \( (9, 12) \)  
(c) \( (0, 7) \) and \( (6, 1) \)  
(d) \( (-5, 2) \) and \( (5, -4) \)  
(e) \( (-3, 9) \) and \( (7, -1) \)  
(f) \( (0, -4) \) and \( (9, 0) \)  
(g) \( (-10, -6) \) and \( (-2, 8) \)  
(h) \( (0, 5) \) and \( (-11, -10) \)  
(i) \( (9, 8) \) and \( (4, 8) \)

Question 2: Find the midpoint of the line connecting these pairs of points

(a) \( (2, 4) \) and \( (6, 10) \)  
(b) \( (1, 4) \) and \( (9, 12) \)  
(c) \( (0, 7) \) and \( (6, 1) \)  
(d) \( (-5, 2) \) and \( (5, -4) \)  
(e) \( (-3, 9) \) and \( (7, -1) \)  
(f) \( (0, -4) \) and \( (9, 0) \)  
(g) \( (-10, -6) \) and \( (-2, 8) \)  
(h) \( (0, 5) \) and \( (-11, -10) \)  
(i) \( (9, 8) \) and \( (4, 8) \)

Question 3: M is the midpoint of PQ in each diagram below. Find the coordinates of Q in each diagram.

(a) \( (2, 4) \) and \( (6, 10) \)  
(b) \( (1, 4) \) and \( (9, 12) \)  
(c) \( (0, 7) \) and \( (6, 1) \)  
(d) \( (-5, 2) \) and \( (5, -4) \)  
(e) \( (-3, 9) \) and \( (7, -1) \)  
(f) \( (0, -4) \) and \( (9, 0) \)  
(g) \( (-10, -6) \) and \( (-2, 8) \)  
(h) \( (0, 5) \) and \( (-11, -10) \)  
(i) \( (9, 8) \) and \( (4, 8) \)

Extend

Question 1: A is the midpoint of the line PQ. B is the midpoint of the line PR. M is the midpoint of the line AB. Find the coordinates of the point M

Question 2: M is the midpoint of the line AB. The coordinates of the point M are \( (7, 2) \). The coordinates of the point B are \( (11, 8) \). The coordinates of the point C are \( (7, -4) \). Find the area of triangle ACM.
**Answers**

**Question 1:**

(a) (3, 3)    (b) (2, 3)    (c) (3, 3)
(d) (1, 1)    (e) (−2, 1)   (f) (0.5, 0)

**Question 2**

(a) (4, 7)    (b) (5, 8)    (c) (3, 4)
(d) (0, −1)   (e) (2, 4)    (f) (4.5, −2)
(g) (−6, 1)   (h) (−5.5, −2.5) (i) (6.5, 8)

**Question 3:**

(a) (9, 11)   (b) (7, 6)    (c) (3, 5)

**Extend:**

Question 1: (−2, 2.5)
Question 2: 12cm²

**Progress check**

You should now complete quiz number **200** on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

<table>
<thead>
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<th>Score:</th>
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<tbody>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Date completed:</th>
<th></th>
</tr>
</thead>
</table>
Unitary method

Key points

- We can divide quantities into ratios.
- In order to do this, we find the value of one part and then use this to find out how much each share is worth.

Examples – Video tutorials

Unitary method

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Keith buys 6 pencils for 90p
(a) How much does one pencil cost?
(b) How much would five pencils cost?
(c) How much would eleven pencils cost?

Question 2: Jack and Harry are waiters in a restaurant.
They are both paid the same amount of money for each hour that they work.
Jack worked 6 hours and is paid £48
Harry worked 8 hours.
How much money is Harry paid?

Question 3: A car travels 120 miles in 3 hours at a steady speed.
(a) How far does the car travel in 1 hour?
(b) How far does the car travel in 8 hours?

Question 4: A plumber charges £140 for a 4 hour job.
How much does the plumber charge for a 3 hour job?

Rebecca is making Chilli Con Carne. Here is a list of ingredients to serve 6 people.

Rebecca wants to make enough Chilli Con Carne for 4 people.
How much of each ingredient does Rebecca need?

Extend

Question 3: A car uses 8.4 litres of petrol for a 112 mile journey.
When the tank is full, the car holds 54 litres of petrol.
How far should the car be able to travel on a full tank of petrol?

Question 4: A 345ml tin of paint costs £4.80
A 250ml tin of paint costs £3.35
Which tin is better value for money?
Answers

Question 1: (a) 15p (b) 75p (c) £1.65

Question 2: £64

Question 3: (a) 40 miles (b) 320 miles

Question 4: £105

Question 8:
0.8kg mince
280g tomatoes
2 chillies
400 kidney beans

Question 3: 720 miles

Question 4: The 250ml is better value for money.
# Skills challenge 2

(Numeracy Ninjas)

**Instructions**

- Complete the 30 questions below. You have **20 minutes maximum**.
- Time yourself. See how long it takes you to complete all of the questions.
- Ask your parent or sibling to check your answers when you are finished.
- Record your score and time taken to complete all 30 questions below.

### MENTAL STRATEGIES - do these in your head

<table>
<thead>
<tr>
<th>Q</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 - □ + 2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Double 1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Halve 39</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>51 + 30 = □</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>44 + 47 = □</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6 ÷ 4 = □</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>12 + 13 = 12 + 8 + □</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>47 - 9 = 47 - 7 - □</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9 + 363 = □</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>48 + 61 = 48 + 60 + □</td>
<td></td>
</tr>
</tbody>
</table>

**Total out of 10**

### TIME TABLES - do these in your head

<table>
<thead>
<tr>
<th>Q</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8 × □ = 32</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>□ ÷ 10 = 5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>8 × 5 = □</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3 × 7 = □</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>18 ÷ □ = 3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>□ × 7 = 56</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3 × □ = 24</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>20 ÷ 5 = □</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>42 ÷ 7 = □</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>8 × 9 = □</td>
<td></td>
</tr>
</tbody>
</table>

**Total out of 10**

### KEY SKILLS - you may use written calculations for these questions

<table>
<thead>
<tr>
<th>Q</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>344 ÷ 4 = □</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8 × 2 + 1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>765.28 ÷ 8</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>7.83 + 88.91</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>(−36) + (−4)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>If a = 3, b = 7 and c = 4, what is the value of 2ab - c?</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>6 − (−2)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Is 7 a factor of 24?</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>What is the positive value of ( \sqrt{1} )?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>What is 150% of £290?</td>
<td></td>
</tr>
</tbody>
</table>

**Total out of 10**

---

**Score:** / 30

**Time taken:** :

---

**Best value for money**
Key points

- We can use the unitary method (see previous lesson) to compare which offers provide best value for money.
- We need to make sure we are comparing like for like when trying to find the best value for money.

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Best value for money

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: For each pair, decide which is better value for money.

(a) 1 ticket for £8 or 3 tickets for £20
(b) 1 sandwich for £2.50 or 2 sandwiches for £5.20
(c) 2 pizzas for £12 or 4 pizzas for £28
(d) 3 doughnuts for 60p or 6 doughnuts for £1

Question 1: Mr McLean wants to hire a taxi.
He rings three different taxi companies and asks them for their prices.

A1 Taxis: A 5 mile journey costs £15
Crazy Cabs: A 4 mile journey costs £13
Value Cars: A 10 mile journey costs £28

Order the taxi companies from best to least value for money.

Extend

Question 4: Flower pots normally cost £4 each.

Two shops have special offers.

Gardenbase 20% off
Lawn Factory Buy 5 get 2 free

Answers

Question 1

(a) 3 tickets for £20
(b) 1 sandwich at £2.50
(c) 2 pizzas for £12
(d) 6 doughnuts for £1

Question 1: Best to least – Value Cars, A1 taxis, Crazy Cabs

Question 4: Lawn Factory
Progress check

You should now complete quiz number 764 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
</tr>
</thead>
</table>

| Date completed: |   |
Key points

- We write large or small numbers in standard form to make calculations easier.
- Numbers in standard form are always in the same format: \( A \times 10^n \), where \( 1 \leq A < 10 \) and \( n \) is any positive or negative integer.
- E.g. 50,000 can be written as \( 5 \times 10^{4} \), which is the same as \( 5 \times 10^{0} \).
- E.g. 0.006 can be written as \( 6 \times 0.001 \), which is the same as \( 6 \times 10^{-3} \).
- Remember that, for large numbers, \( n \) is positive and, for small numbers, \( n \) is negative.
- Note that \( 64 \times 10^{4} \) is not standard form, as 64 is not in the range \( 1 \leq A < 10 \).

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Standard Form – Video 300

Scan the QR code above using your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Write each of the following numbers in standard form.

(a) 40000  (b) 200000  (c) 800000  (d) 7000
(e) 10000000  (f) 900  (g) 250000  (h) 1900
(i) 5400000  (j) 11000000  (k) 89000  (l) 3600000000
(m) 43500  (n) 91900000  (o) 1230000000  (p) 71120

Question 2: Write each of the following as ordinary numbers

(a) $3 \times 10^4$  (b) $9 \times 10^3$  (c) $6 \times 10^6$  (d) $2 \times 10^{10}$
(e) $5 \times 10^7$  (f) $1.2 \times 10^2$  (g) $2.9 \times 10^5$  (h) $8.4 \times 10^8$
(i) $7.7 \times 10^4$  (j) $3.51 \times 10^5$  (k) $9.89 \times 10^7$  (l) $1.27 \times 10^9$
(m) $4.05 \times 10^6$  (n) $1.616 \times 10^5$  (o) $2.0651 \times 10^3$  (p) $8.829 \times 10^7$

Question 3: Write each of the following numbers in standard form.

(a) 0.002  (b) 0.0005  (c) 0.9  (d) 0.00000004
(e) 0.00065  (f) 0.0022  (g) 0.0361  (h) 0.000558
(i) 0.00000423  (j) 0.0000000981  (k) 0.00407  (l) 0.02052
(m) 0.0000515  (n) 0.006015  (o) 0.000000082  (p) 0.00007005

Question 4: Write each of the following as ordinary numbers

(a) $2 \times 10^{-3}$  (b) $7 \times 10^{-2}$  (c) $3 \times 10^{-6}$  (d) $9 \times 10^{-8}$
(e) $4.8 \times 10^{-4}$  (f) $6.7 \times 10^{-3}$  (g) $9.2 \times 10^{-6}$  (h) $4.1 \times 10^{-2}$
(i) $3.16 \times 10^{-5}$  (j) $8.62 \times 10^{-4}$  (k) $7.09 \times 10^{-6}$  (l) $5.71 \times 10^{-3}$
(m) $2.05 \times 10^{-8}$  (n) $4.112 \times 10^{-2}$  (o) $1.651 \times 10^{-3}$  (p) $2.0019 \times 10^{-7}$

Question 5: Write these numbers in standard form

(a) one million  (b) nine thousand  (c) forty thousand  (d) nine billion
(e) $500^2$  (f) $200^3$  (g) $30,000^2$  (h) two thousandths
Extend

Question 1: The distance between London and New York is 5,567,000 metres. Write this number in standard form.

Question 2: The distance from the Sun to Pluto is 3.67 billion miles. Write this number in standard form.

Question 3: The length of a cell is 0.016 mm. Write this number in standard form.

Question 4: The population of a country is \(6.51 \times 10^5\). Write the population of the country as an ordinary number.

Question 5: 32,010 people attend a football match between West Ham and Southampton. Write this number in standard form.

Answers

Question 1:

a) \(4 \times 10^4\)  
b) \(2 \times 10^6\)  
c) \(8 \times 10^6\)  
d) \(7 \times 10^5\)  
e) \(1 \times 10^3\)  
f) \(9 \times 10^2\)  
g) \(2.5 \times 10^5\)  
h) \(1.9 \times 10^3\)  
i) \(5.4 \times 10^7\)  
j) \(1.1 \times 10^7\)  
k) \(8.9 \times 10^4\)  
l) \(3.6 \times 10^9\)  
m) \(4.35 \times 10^4\)  
n) \(9.19 \times 10^7\)  
o) \(1.23 \times 10^9\)  
p) \(7.112 \times 10^8\)

Question 2:

a) 30,000  
b) 9000  
c) 6,000,000  
d) 20,000,000,000  
e) 50,000,000  
f) 120  
g) 290,000  
h) 840,000,000  
i) 77,000  
j) 351,000  
k) 98,900,000  
l) 1,270,000,000  
m) 4,050,000  
n) 161,600  
o) 2065.1  
p) 88,290,000
Question 3
a) \(2 \times 10^{-3}\) b) \(5 \times 10^{-4}\) c) \(9 \times 10^{-1}\) d) \(4 \times 10^{-6}\)
e) \(6.5 \times 10^{-4}\) f) \(2.2 \times 10^{-3}\) g) \(3.61 \times 10^{-2}\) h) \(5.58 \times 10^{-4}\)
i) \(4.23 \times 10^{-5}\) j) \(9.81 \times 10^{-8}\) k) \(4.07 \times 10^{-3}\) l) \(2.052 \times 10^{-2}\)
m) \(5.15 \times 10^{-5}\) n) \(6.015 \times 10^{-3}\) o) \(8.2 \times 10^{-9}\) p) \(7.005 \times 10^{-5}\)

Question 4:
a) 0.002 b) 0.07 c) 0.000003 d) 0.00000009
e) 0.00048 f) 0.0067 g) 0.0000092 h) 0.041
i) 0.0000316 j) 0.000862 k) 0.00000709 l) 0.00571
m) 0.00000000205 n) 0.04112 o) 0.001651 p)

Question 5:
a) 1,000,00 b) 9000 c) 40,000 d) 9,000,000,000
e) 250,000 f) 8,000,000 g) 900,000,000 h) 0.002

Question 1: \(5.567 \times 10^6\)
Question 2: \(3.67 \times 10^9\)
Question 3: \(1.6 \times 10^2\)
Question 4: 651,000
Question 5: \(3.201 \times 10^6\)
Progress check

You should now complete quiz numbers 122 and 123 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

**Quiz 122**

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**Quiz 123**

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**Skills challenge 3**
(Numeracy Ninjas)

**Instructions**
- Complete the 30 questions below. You have **20 minutes maximum**.
- Time yourself. See how long it takes you to complete all of the questions.
- Ask your parent or sibling to check your answers when you are finished.
- Record your score and time taken to complete all 30 questions below.

<table>
<thead>
<tr>
<th>MENTAL STRATEGIES - do these in your head</th>
<th>TIMETABLES - do these in your head</th>
<th>KEY SKILLS - you may use written calculations for these questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>Question</td>
<td>Answer</td>
</tr>
<tr>
<td>----</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>1</td>
<td>8 + □ = 20</td>
<td>□</td>
</tr>
<tr>
<td>2</td>
<td>Double 20</td>
<td>□</td>
</tr>
<tr>
<td>3</td>
<td>173 + 10 = □</td>
<td>□</td>
</tr>
<tr>
<td>4</td>
<td>99 − 70 = □</td>
<td>□</td>
</tr>
<tr>
<td>5</td>
<td>□ ÷ 3 = 3 + 3</td>
<td>□</td>
</tr>
<tr>
<td>6</td>
<td>102 − 90 = □</td>
<td>□</td>
</tr>
<tr>
<td>7</td>
<td>62 + 15 = 62 + 8 + □</td>
<td>□</td>
</tr>
<tr>
<td>8</td>
<td>37 − 9 = 37 − 7 − □</td>
<td>□</td>
</tr>
<tr>
<td>9</td>
<td>□ × 3 = 3 + 3 + 3</td>
<td>□</td>
</tr>
<tr>
<td>10</td>
<td>What time is shown on the clock?</td>
<td>pm</td>
</tr>
</tbody>
</table>

**Total out of 10**

Score: / 30

Time taken: :
### Nth term rule of linear sequences

**Key points**

- A linear sequence is one that goes up or down by the same amount from term to term. For example, 3, 7, 11, 15, ... is a linear sequence as it increases by 4 from term to term. 40, 38, 36, 34, ... is also a linear sequence as it decreases by 2 from term to term.
- The $n$th rule is a general rule that helps to find any term in a linear sequence.
- The $n$th term rule of a linear sequence is written in the form $an + b$.

**Examples – Video tutorials**

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Nth term of linear sequences

Scan the QR code above with your mobile phone

*or click on the QR code to follow the hyperlink*
### Practice

**Question 1:** Find the \( n \)th term for each of the following sequences

<p>| | | | |</p>
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<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>(a)</td>
<td>5, 8, 11, 14, ...</td>
<td>(b)</td>
<td>9, 14, 19, 24, ...</td>
</tr>
<tr>
<td>(d)</td>
<td>10, 14, 18, 22, ...</td>
<td>(e)</td>
<td>2, 7, 12, 17, ...</td>
</tr>
<tr>
<td>(g)</td>
<td>11, 31, 51, 71, ...</td>
<td>(h)</td>
<td>20, 23, 26, 29, ...</td>
</tr>
<tr>
<td>(j)</td>
<td>100, 125, 150, 175, ...</td>
<td>(k)</td>
<td>13, 22, 31, 40, ...</td>
</tr>
</tbody>
</table>

**Question 4:** The \( n \)th term for some sequences are given below. Find the first 5 terms for each sequence.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>( 5n + 3 )</td>
<td>(b)</td>
<td>( 2n + 9 )</td>
</tr>
<tr>
<td>(d)</td>
<td>( 10n - 6 )</td>
<td>(e)</td>
<td>( 9n + 10 )</td>
</tr>
<tr>
<td>(g)</td>
<td>( -7n + 20 )</td>
<td>(h)</td>
<td>( 50 - 5n )</td>
</tr>
</tbody>
</table>

### Extend

**Question 4:** Here are the \( n \)th terms of 4 sequences.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence 1</td>
<td>( n )th term</td>
<td>( 4n + 3 )</td>
</tr>
<tr>
<td>Sequence 2</td>
<td>( n )th term</td>
<td>( 7n + 1 )</td>
</tr>
<tr>
<td>Sequence 3</td>
<td>( n )th term</td>
<td>( 14n )</td>
</tr>
<tr>
<td>Sequence 4</td>
<td>( n )th term</td>
<td>( 8n - 1 )</td>
</tr>
</tbody>
</table>

For each sequence state whether the numbers in the sequence are

A Always multiples of 7
S Sometimes multiples of 7
N Never multiples of 7

Sequence 1 .......... Sequence 2 .......... Sequence 3 .......... Sequence 4 ..........

### Answers

**Question 1**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>( 3n+2 )</td>
<td>(b)</td>
<td>( 5n+4 )</td>
</tr>
<tr>
<td>(e)</td>
<td>( 5n-3 )</td>
<td>(f)</td>
<td>( 6n-3 )</td>
</tr>
<tr>
<td>(i)</td>
<td>( 6n-5 )</td>
<td>(j)</td>
<td>( 25n+75 )</td>
</tr>
</tbody>
</table>
Progress check

You should now complete **quiz number 198** on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date completed:  
Expanding single brackets

Key points

- When expanding a single bracket, you need to multiply each term inside the bracket by the term outside. For example, in the question below you would multiply \( x \) by 5 and then multiply 3 by 5. This would result in \( 5x + 15 \).

\[ 5(x + 3) \]

- You can also use the grid method to expand brackets, as below. This would result in \( 6x + 12 \).

\[ \begin{array}{c|c}
2x & + 4 \\
3 & \\
\end{array} \]

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Expanding brackets

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Expand the following brackets

(a) 5(y + 3)   (b) 4(a + 2)   (c) 8(w + 10)   (d) 3(x - 7)
(e) 9(s - 1)   (f) 2(8 - t)   (g) 7(4 + h)   (h) 10(a + 2b + 3c)
(i) 4(3y + 2)  (j) 5(2p - 1)  (k) 3(7a + 2)  (l) 9(2x - 5)
(m) 5(4 + 3t)  (n) 7(9 - 2c)  (o) 8(3w + 1)  (p) 9(1 - 4p)
(q) 11(2k - 5) (r) 20(6a + 5c) (s) 3(15w - 7) (t) 3(9 - 2a)

Question 2: Expand the following brackets

(a) -2(w + 5)  (b) -3(c + 7)  (c) -8(c + 7)  (d) -10(y - 2)
(e) -7(g - 3)  (f) -4(2w + 3) (g) -9(3w - 5) (h) -9(5x - 1)
(i) -5(6 - c)  (j) -6(4 + 3m) (k) -2(1 + 9c) (l) -5(8a - 7w)

Question 5: Expand and simplify

(a) 5(y + 3) + 2(y + 7)  (b) 6(2w + 5) + 9(w + 2)  (c) 3(y - 2) + 4(2y + 5)
(d) 7(2g + 3) - 5(g + 2)  (e) 6(x - 2) - 4(x - 8)  (f) 2(3y - 8) - 5(2y - 1)

Extend

Question 1: Can you spot any mistakes in the questions below.

Expand 3(2y - 1)  Multiply out x(x + 3)

6y - 1  2x + 3x = 5x

Expand and simplify 6(w + 3) - 2(w - 5)

6w + 18 - 2w - 10

= 4w + 8
### Answers

**Question 1**

(a) $5y + 15$  
(b) $4a + 8$  
(c) $8w + 80$  
(d) $3x - 21$  
(e) $9s - 9$  
(f) $16 - 2t$  
(g) $28 + 7h$  
(h) $10a + 20b + 30c$  
(i) $12y + 8$  
(j) $10p - 5$  
(k) $21a + 6$  
(l) $18x - 45$  
(m) $20 + 15t$  
(n) $63 - 14c$  
(o) $24w + 8$  
(p) $9 - 36p$  
(q) $22k - 55$  
(r) $120a + 100c$  
(s) $45w - 21$  
(t) $27 - 6a$

**Question 2:**

(a) $-2w - 10$  
(b) $-3c - 21$  
(c) $-8c - 56$  
(d) $-10y + 20$  
(e) $-7g + 21$  
(f) $-8w - 12$  
(g) $-27w + 45$  
(h) $-45x + 9$  
(i) $-30 + 5c$  
(j) $-24 - 18m$  
(k) $-2 - 18c$  
(l) $-40a + 35w$

**Question 5:**

(a) $7y + 29$  
(b) $21w + 48$  
(c) $11y + 14$  
(d) $9g + 11$  
(e) $2x + 20$  
(f) $-4y - 11$  
(g) $5y + 7m$  
(h) $26$

(l) $18 + 15y$

---

Question 1(a) the -1 needed to be multiplied by 3 as well. Answer = $6y - 3$

Question 1(b) x multiplied by $x = x^2$. So the answer is $x^2 + 3x$

Question 1(c) -2 multiplied by -5 is +10, not -10. Answer $4w + 28$.

### Progress check

You should now complete **quiz number 160** on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>


Skills challenge 4
(Numeracy Ninjas)

Instructions

- Complete the 30 questions below. You have **20 minutes maximum**.
- Time yourself. See how long it takes you to complete all of the questions.
- Ask your parent or sibling to check your answers when you are finished.
- Record your score and time taken to complete all 30 questions below.

### MENTAL STRATEGIES - do these in your head

<table>
<thead>
<tr>
<th>Q</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 + □ = 5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>□ + 2 = 100</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>What is half of 8?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>148 - 10 = □</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>94 + □ = 100</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>82 = 50 + □</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7407 - 7398 = □</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2 × 6 = 12, so 12 ÷ 6 = □</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>What is 10:10 am in 24 hour clock format?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>What time was it 31 minutes before 16:16?</td>
<td></td>
</tr>
</tbody>
</table>

**Total out of 10**

### TIMES TABLES - do these in your head

<table>
<thead>
<tr>
<th>Q</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4 ÷ □ = 2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>□ × 10 = 40</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3 × □ = 21</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>15 + □ = 3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>81 ÷ 9 = □</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>□ × 7 = 35</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>□ × 4 = 16</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>30 ÷ 3 = □</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>16 + □ = 4</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>50 ÷ 5 = □</td>
<td></td>
</tr>
</tbody>
</table>

**Total out of 10**

### KEY SKILLS - you may use written calculations for these questions

<table>
<thead>
<tr>
<th>Q</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17 × 519 = □</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1581 - 801</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2.93 × 8</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.58 ÷ 1000</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>(-4) × 7</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Round 1.8532 to 3 decimal places</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>5 + (-2)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Round 1.9966 to 2 s.f.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>What is the letter at (1, -1)?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F G H I J</td>
<td></td>
</tr>
<tr>
<td></td>
<td>K L M N P x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q R S T U</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V W X Y Z</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>What is 4/8 of 167?</td>
<td></td>
</tr>
</tbody>
</table>

**Total out of 10**

Score:    / 30

Time taken:    :
Factorising expressions

Key points

- Factorising is the opposite process to expanding.
- We look for common factors in both terms and using the highest common factor (HCF), we write the expression using brackets.

Examples – Video tutorials

CLIP NUMBER: 168 & 169

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Factorising

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Factorise the following expressions

(a) $4x + 6$  (b) $15x + 20$  (c) $9y - 12$  (d) $5x + 15$
(e) $6x - 3$  (f) $4x + 8$  (g) $5y - 25$  (h) $8w + 24$
(i) $10y + 15$  (j) $14w + 21$  (k) $20y - 30$  (l) $27x + 18$
(m) $6 - 4x$  (n) $9 + 12y$  (o) $45 + 60x$  (p) $16y - 32$

Question 2: Factorise the following expressions

(a) $x^2 + 7x$  (b) $x^2 - 3x$  (c) $y^2 + y$  (d) $w^2 + 9w$
(e) $x^2 - 7x$  (f) $4w^2 + 10w$  (g) $6x^2 - 8x$  (h) $9y^2 - 6y$

Question 3: Factorise the following expressions

(a) $x^2 + xy$  (b) $a^2 - ab$  (c) $xy + xz$  (d) $ab + ac - ad$
(e) $6c^2 - 4cd$  (f) $10x^2 + 15xy$  (g) $12ab + 18bc$  (h) $8xy + 4y^2$

Question 4: Factorise the following expressions

(a) $x^3 + 2x^2$  (b) $5x^3 - x^2$  (c) $8c^3 + 12c$  (d) $10w^2 - 15w^3$

Extend

Question 1: Explain why $8x + 3y$ cannot be factorised.

Question 2: James has factorised an expression correctly. His answer is $2(7y - 3)$. What was the expression that he factorised?

Question 3: Alexandra is trying to factorise fully $15y + 30$. Rebecca says the answer is $3(5y + 10)$, Victoria says the answer is $5(3y + 6)$. Alexandra says both Rebecca and Victoria are incorrect, why?
Answers

<table>
<thead>
<tr>
<th>Question 1</th>
<th>(a) 2(2x + 3)</th>
<th>(b) 5(3x + 4)</th>
<th>(c) 3(3y - 4)</th>
<th>(d) 5(x + 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e) 3(2x - 1)</td>
<td>(f) 4(x + 2)</td>
<td>(g) 5(y - 5)</td>
<td>(h) 8(w + 3)</td>
<td></td>
</tr>
<tr>
<td>(i) 5(2y + 3)</td>
<td>(j) 7(2w + 3)</td>
<td>(k) 10(2y - 3)</td>
<td>(l) 9(3x + 2)</td>
<td></td>
</tr>
<tr>
<td>(m) 2(3 - 2x)</td>
<td>(n) 3(3 + 4y)</td>
<td>(o) 15(3 + 4x)</td>
<td>(p) 16(y - 2)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 2</th>
<th>(a) x(x + 7)</th>
<th>(b) x(x - 3)</th>
<th>(c) y(y + 1)</th>
<th>(d) w(w + 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e) x(x - 7)</td>
<td>(f) 2w(2w + 5)</td>
<td>(g) 2x(3x - 4)</td>
<td>(h) 3y(3y - 2)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 3</th>
<th>(a) x(x + y)</th>
<th>(b) a(a - b)</th>
<th>(c) x(y + z)</th>
<th>(d) a(b + c - d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e) 2c(3c - 2d)</td>
<td>(f) 5x(2x + 3y)</td>
<td>(g) 6b(2a + 3c)</td>
<td>(h) 4y(2x + y)</td>
<td></td>
</tr>
</tbody>
</table>

| Question 4 | (a) x^2(x + 2) | (b) x^2(5x - 1) | (c) 4c(2c^2 + 3) | (d) 5w^2(2 - 3w) |

Question 1
There is no common factor available.

Question 2
14y - 6

Question 3
Neither Rebecca nor Victoria have factorised fully. The answer should be 15(y + 2)

Progress check

You should now complete quiz numbers **168 and 169** on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

**Quiz 168**

<table>
<thead>
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<th>Score:</th>
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**Quiz 169**

<table>
<thead>
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<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>
Expanding brackets involving simplifying

Key points

- Follow BIDMAS - expand both brackets first
- Pay careful attention to the sign before the second bracket.
- Then collect the like terms, remembering the sign in front
e.g.

1) \(3(a+3) + 2(a-2)\)  
2) \(3(a+3)-2(a-2)\)  

\[
\begin{align*}
3a+9+2a-4 & \quad 3a+9-2a+4 \\
5a+5 & \quad a+13
\end{align*}
\]

Hint: because \(-2\) is on the outside of the bracket you multiply everything inside the bracket by \(-2\)
i.e. \(-2 \times a = -2a\)  
\(-2 \times -2 = +4\)

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Expanding brackets

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1
Expand the brackets and simplify

a) 3(a + 5) + 2a  

b) 5(2a + 3) - 3a  

c) 4(3a + 2) + 6a  

d) 5(2a - 4) + a + 4  

e) 2(3a + 5) - 5a - 9  

f) 5(3a + 5) + 5a - 5  

g) 3(x + 4) + 5(x + 2)  

h) 2(x + 5) + 3(x - 2)  

i) 4(2x + 4) + 3(x - 1)  

j) 6(2x - 3) + 3(a + 1)  

k) 2(8a - 2) + 4(a + 1)  

l) 4(2x - 1) + 3(3x - 2)  

Question 2
Expand and Simplify

(a) 5(y + 3) + 2(y + 7)  

(b) 6(2w + 5) + 9(w + 2)  

(c) 3(y - 2) + 4(2y + 5)  

(d) 7(2g + 3) - 5(g + 2)  

(e) 6(x - 2) - 4(x - 8)  

(f) 2(3y - 8) - 5(2y - 1)  

(g) 8(5 + 2m) + 3(5 - 3m)  

(h) 4(w + 7) - 2(2w + 1)  

(i) 9(1 + 2y) + 3(3 - y)  

Extend

Question 1
Expand and Simplify

(a) w(w + 5) + w(w + 7)  

(b) 2g(4g + 3) + g(g - 7)  

(c) n(n - 4) - n(5 - n)  

(d) 2e(4e + 3) - 3e(e - 5)  

(e) a(3 + c) + c(a + 2)  

(f) m(a + 7) - a(4 - 3m)  

(g) 8c(8 - 3a) + 3(4 - c)  

(h) 5(3y + z) - 2y(4y - 3z)  

(i) 4c(3c - c^2) - 2c^2(4 - 5c)  

Question 2

Show that 2(4a + 1) - 4(a - 3) = 4a + 14
Answers

Question 1

a) 5a+15  
   b) 7a+15  
   c) 18a+8  
   d) 11a-16  
   e) a+1  
   f) 20a+20  
   g) 8x+22  
   h) 5x-4  
   i) 11x+13  
   j) 3a+12x-15  
   k) 20a  
   l) 17x-10

Question 2

(a) 7y + 29  
   (b) 21w + 48  
   (c) 11y + 14  
   (d) 9g + 11  
   (e) 2x + 20  
   (f) -4y - 11  
   (g) 55 + 7m  
   (h) 26  
   (i) 18 + 15y

Extend

Question 1

(a) 2w^2 + 12w  
   (b) 9g^2 - g  
   (c) 2n^2 - 9n  
   (d) 5e^2 + 21e  
   (e) 3a + 2ac + 2c  
   (f) 4am + 7m - 4a  
   (g) 61c - 24ac + 12  
   (h) 7y^2 + 11yz  
   (i) 4c^2 + 6c^3

Question 2

Show that \(2(4a+1)-4(a-3) = 4a+14\)

\[8a+2-4a+12=12\]
\[8a-4a+2+12\]
\[4a+14\]

Progress check

You should now complete quiz number 161 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
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</table>

Date completed:  

Skills challenge 5
(Numeracy Ninjas)

Instructions

- Complete the 30 questions below. You have **20 minutes maximum**.
- Time yourself. See how long it takes you to complete all of the questions.
- Ask your parent or sibling to check your answers when you are finished.
- Record your score and time taken to complete all 30 questions below.

<table>
<thead>
<tr>
<th>MENTAL STRATEGIES - do these in your head</th>
<th>TIMESTABLES - do these in your head</th>
<th>KEY SKILLS - you may use written calculations for these questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Q</strong></td>
<td><strong>Question</strong></td>
<td><strong>Answer</strong></td>
</tr>
<tr>
<td>1</td>
<td>$10 = \square + 7$</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>What is double 7?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Halve 98</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$99 + 80 = \square$</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$81 + 80 = \square$</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>$39 + 5 = 39 + 1 + \square$</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>$308 - 301 = \square$</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>$5 + 904 = \square$</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>$3 + 3 + 3 + 3 + \square = \square \times 3$</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>$15 + 87 = 10 + 80 + \square$</td>
<td></td>
</tr>
</tbody>
</table>

**Total out of 10**

| **Score:** | **/ 30** | **Time taken:** | **:** |
Rearranging formulae

Key points

• You can rearrange a formula to make one of the variables (letters) the subject.
• The subject of a formula is the variable that is on its own on one side of the equals, usually on the left. For example, ‘V’ is the subject of the formula ‘V = E + RI’.
• Rearranging formulae involves manipulating both sides of an equation, keeping it balanced, to make a different variable the subject.
• This means that rearranging formulae is also known as ‘changing the subject of a formula’.
• Think of rearranging formulae like solving an equation, using inverse operations until the subject you want is on its own, making sure you follow the correct order of operations.
• For example, to make ‘a’ the subject of ‘\( v = u + as \)’, first subtract ‘u’ from both sides. This gives you ‘\( v - u = as \)’. Then divide both sides by ‘s’. This gives you ‘\( \frac{v-u}{s} = a \)’.
   As ‘a’ is now on its own, we can say that ‘a’ is the subject of the formula.

Examples – Video tutorials

CLIP NUMBER: 280, 281, 282, 283 & 284

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Changing the subject

Scan the QR code above using your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Make \( y \) the subject of each of the following

(a) \( y + w = c \)  
(b) \( y - p = m \)  
(c) \( m + y = s \)

(d) \( y - 2g = n \)  
(e) \( 3y = c \)  
(f) \( ay = w \)

(g) \( \frac{y}{c} = w \)  
(h) \( \frac{y}{a} = 2c \)  
(i) \( a = y + p \)

(j) \( c = y - k \)  
(k) \( y^2 = s \)  
(l) \( y^3 = x \)

(m) \( \sqrt{y} = g \)  
(n) \( \pi y = c \)  
(o) \( n - y = t \)

(p) \( ry = c \)  
(q) \( 4\pi y = b \)  
(r) \( y + 7t = c + r \)

(s) \( \frac{r}{y} = w \)  
(t) \( y^2 = k + x \)  
(u) \( A = xy \)

Question 2: Make \( x \) the subject of the following formulae

(a) \( 4x + c = w \)  
(b) \( dx - t = 8 \)  
(c) \( x^2 + 3 = h \)

(d) \( 2x + 2y = P \)  
(e) \( s = x^2 - 3 \)  
(f) \( y = xz + s \)

(g) \( \frac{x}{n} + 2 = w \)  
(h) \( \frac{x}{6} - 5 = w \)  
(i) \( \frac{x + 3}{c} = h \)

(j) \( 3y = 4x + 1 \)  
(k) \( x^2 + a = v \)  
(l) \( x^2 - 4 = 5y \)

(m) \( \frac{x + t}{m} = 2c \)  
(n) \( \frac{w + x}{u} = 3z \)  
(o) \( A = \pi x^2 \)

Extend

Question 1: The circumference of a circle is given as \( c = 2\pi r \)  
Make the radius, \( r \), the subject of the formula.

Question 2: The formula to convert degrees Fahrenheit to degree Celsius is \( \frac{5}{9} (F - 32) = C \)  
Find the formula to convert from degrees Celsius to degrees Fahrenheit by making \( F \) the subject.
Answers

Question 1:
(a) \( y = c - w \)  
(b) \( y = m + p \)  
(c) \( y = s - m \)

(d) \( y = n + 2g \)  
(e) \( y = \frac{c}{3} \)  
(f) \( y = \frac{w}{a} \)

(g) \( y = cw \)  
(h) \( y = 2ac \)  
(i) \( y = a - p \)

(j) \( y = c + k \)  
(k) \( y = \sqrt{s} \)  
(l) \( y = \sqrt{x} \)

(m) \( y = g^2 \)  
(n) \( y = \frac{c}{\pi} \)  
(o) \( y = n - t \)

(p) \( y = \frac{c}{r} \)  
(q) \( y = \frac{b}{4\pi} \)  
(r) \( y = c + r - 7t \)

(s) \( y = \frac{r}{w} \)  
(t) \( y = \sqrt{k + x} \)  
(u) \( y = \frac{A}{x} \)

Question 2:
(a) \( x = \frac{w - c}{4} \)  
(b) \( x = \frac{8 + t}{d} \)  
(c) \( x = \sqrt{h - 3} \)

(d) \( x = \frac{P - 2y}{2} \)  
(e) \( x = \sqrt{s + 3} \)  
(f) \( x = \frac{y - s}{z} \)

(g) \( x = n(w - 2) \)  
(h) \( x = 6(w + 5) \)  
(i) \( x = ch - 3 \)

(j) \( x = \frac{3y - 1}{4} \)  
(k) \( x = \sqrt{v - a} \)  
(l) \( x = \sqrt[3]{5y + 4} \)

(m) \( x = 2cm - t \)  
(n) \( x = 3uz - w \)  
(o) \( x = \frac{\sqrt{A}}{\pi} \)

Extend answers

\[ T = \frac{c}{2\pi} \]

\[ F = \frac{9}{5} C + 32 \]

Progress check

You should now complete quiz number 282 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>

47
Pythagoras’ theorem

Key points

- We can use Pythagoras’ theorem to find a missing side on a right-angled triangle when given two other sides.
- The side opposite the right-angle is called the hypotenuse. It is always the longest side of the triangle. We label this side c.
- The two shorter sides are labelled a and b.
- Pythagoras’ theorem states: \( c^2 = a^2 + b^2 \)

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Pythagoras’ theorem

[Scan the QR code above with your mobile phone](#)

or click on the QR code to follow the hyperlink
Practice

Question 1: For each right angle triangle below, work out $x$
(a) \[
\begin{array}{c}
3\text{cm} \\
4\text{cm}
\end{array}
\]
(b) \[
\begin{array}{c}
8\text{cm} \\
6\text{cm}
\end{array}
\]
(c) \[
\begin{array}{c}
5\text{cm} \\
12\text{cm}
\end{array}
\]

Question 2: Calculate $x$
Give each answer to 2 decimal places.
(a) \[
\begin{array}{c}
5\text{cm} \\
8\text{cm}
\end{array}
\]
(b) \[
\begin{array}{c}
12\text{cm} \\
30\text{cm}
\end{array}
\]
(c) \[
\begin{array}{c}
9\text{m} \\
2\text{m}
\end{array}
\]

Question 4: For each right angle triangle below, work out $x$
(a) \[
\begin{array}{c}
13\text{cm} \\
12\text{cm}
\end{array}
\]
(b) \[
\begin{array}{c}
6\text{cm} \\
10\text{cm}
\end{array}
\]

Question 6: Calculate $x$ for each right angle triangle.
Give each answer to 2 decimal places.
(a) \[
\begin{array}{c}
4\text{cm} \\
6\text{cm}
\end{array}
\]
(b) \[
\begin{array}{c}
12\text{cm} \\
7\text{cm}
\end{array}
\]
(c) \[
\begin{array}{c}
7\text{cm} \\
20\text{cm}
\end{array}
\]
(d) \[
\begin{array}{c}
1.3\text{km} \\
1.7\text{km}
\end{array}
\]
(e) \[
\begin{array}{c}
35\text{m} \\
51\text{m}
\end{array}
\]
(f) \[
\begin{array}{c}
19\text{cm} \\
9\text{cm}
\end{array}
\]
Extend

Question 5: An airplane is flying from Redville to Leek. The airplane flies 50 miles East and then 180 miles South. How far is Leek from Redville directly?

Question 6: A frame is made from wire. The frame is a trapezium. Calculate the total amount of wire needed to make the frame.

Give your answer to 1 decimal place.

Answers

Question 1:
(a) 5cm  (b) 10cm  (c) 13cm

Question 2:
(a) 9.43cm  (b) 32.31cm  (c) 9.22m

Question 4:
(a) 5cm  (b) 8cm

Question 6:
(a) 7.21cm  (b) 9.75 cm  (c) 18.73cm
(d) 2.14km  (e) 37.09m  (f) 21.02cm

Question 5: 186.82 miles

Question 6: 47.4 cm
Progress check

You should now complete quiz numbers 498 and 499 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

**Quiz 498**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
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</thead>
</table>

**Quiz 499**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>
Skills challenge 6
(Numeracy Ninjas)

Instructions

- Complete the 30 questions below. You have **20 minutes maximum**.
- Time yourself. See how long it takes you to complete all of the questions.
- Ask your parent or sibling to check your answers when you are finished.
- Record your score and time taken to complete all 30 questions below.

<p>| MENTAL STRATEGIES - do these in your head | TIME TABLES - do these in your head | KEY SKILLS - you may use written calculations for these questions |</p>
<table>
<thead>
<tr>
<th>Q</th>
<th>Question</th>
<th>Answer</th>
<th>Q</th>
<th>Question</th>
<th>Answer</th>
<th>Q</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20 = □ + 3</td>
<td>□</td>
<td>1</td>
<td>□ × 7 = 49</td>
<td>2</td>
<td>2 × 10 = □</td>
<td>1</td>
<td>242 + 2047</td>
</tr>
<tr>
<td>2</td>
<td>What is double 22?</td>
<td>□</td>
<td>2</td>
<td>□ × 2 = □</td>
<td>2</td>
<td>(7 - 6)^2 + 1 × 2</td>
<td>2</td>
<td>1000 × 2.73</td>
</tr>
<tr>
<td>3</td>
<td>189 + 10 = □</td>
<td>□</td>
<td>3</td>
<td>□ × 2 = □</td>
<td>3</td>
<td>44 – 8.85</td>
<td>3</td>
<td>Simplify 64/80</td>
</tr>
<tr>
<td>4</td>
<td>55 – 30 = □</td>
<td>□</td>
<td>4</td>
<td>□ × 2 = □</td>
<td>4</td>
<td>Difference between 2 and -2</td>
<td>4</td>
<td>6 Difference between 2 and -2</td>
</tr>
<tr>
<td>5</td>
<td>3 = 2 + □</td>
<td>□</td>
<td>5</td>
<td>□ + 5 = □</td>
<td>5</td>
<td>Value of the dot</td>
<td>5</td>
<td>Is 19 a multiple of 6?</td>
</tr>
<tr>
<td>6</td>
<td>77 – 11 = 77 – □</td>
<td>□</td>
<td>6</td>
<td>□ × 4 = □</td>
<td>6</td>
<td>□ + 8 = □</td>
<td>6</td>
<td>What is the cube root of 125?</td>
</tr>
<tr>
<td>7</td>
<td>9 + 976 = □</td>
<td>□</td>
<td>7</td>
<td>□ + 8 = □</td>
<td>7</td>
<td>□ = 4 = 7</td>
<td>7</td>
<td>7/1 = 49/□</td>
</tr>
<tr>
<td>8</td>
<td>2 + 2 + 2 = □ × 2</td>
<td>□</td>
<td>8</td>
<td>□ × 3 = □</td>
<td>8</td>
<td>2 × 3 = □</td>
<td>8</td>
<td>□ × 5 = □</td>
</tr>
<tr>
<td>9</td>
<td>5 × 2 = 10, so 10 ÷ 5 = □</td>
<td>□</td>
<td>9</td>
<td>□ + 4 = □</td>
<td>9</td>
<td>□ + 4 = □</td>
<td>9</td>
<td>Total out of 10</td>
</tr>
<tr>
<td>10</td>
<td>What time is shown on the clock?</td>
<td>pm</td>
<td>10</td>
<td>□ + 4 = □</td>
<td>10</td>
<td>□ + 4 = □</td>
<td>10</td>
<td>Total out of 10</td>
</tr>
</tbody>
</table>

Score: \( / \ 30 \)  
Time taken: \( : \)
Angles in triangles

Key points

- The sum of angles in a triangle is always $180^\circ$.
- A scalene triangle has 3 different angles and 3 different side lengths.
- An isosceles triangle has equal base angles and 2 sides of the same length.
- An equilateral triangle has 3 equal sides and each angle is $60^\circ$.

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Angles in a triangle

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Find the size of each missing angle.

(a) \[ \begin{array}{c}
80^\circ \\
60^\circ
\end{array} \]

(b) \[ \begin{array}{c}
75^\circ
\end{array} \]

(c) \[ \begin{array}{c}
40^\circ
\end{array} \]

(d) \[ \begin{array}{c}
51^\circ \\
47^\circ
\end{array} \]

(e) \[ \begin{array}{c}
25^\circ
\end{array} \]

(f) \[ \begin{array}{c}
109^\circ \\
32^\circ
\end{array} \]

Question 2: Find the size of each missing angle.

(a) \[ \begin{array}{c}
35^\circ
\end{array} \]

(b) \[ \begin{array}{c}
30^\circ
\end{array} \]

(c) \[ \begin{array}{c}
26^\circ
\end{array} \]

Question 4: Find the size of each missing angle.

(a) \[ \begin{array}{c}
80^\circ \\
125^\circ
\end{array} \]

(b) \[ \begin{array}{c}
68^\circ \\
\end{array} \]

(c) \[ \begin{array}{c}
111^\circ \\
74^\circ
\end{array} \]

Extend

Question 6: The ratio of angles in a triangle is 2:3:5
Find the size of the smallest angle.

Question 7: Find the size of each angle

\[ x + 10 = 3x \]
Answers

Question 1
(a) 40°  (b) 25°  (c) 50°
(d) 82°  (e) 137°  (f) 39°

Question 2
(a) 110°  (b) 75°  (c) 128°

Question 4
(a) 45°  (b) 158°  (c) 143°

Question 6: 36°
Question 7: 34°, 44° and 102°

Progress check

You should now complete quiz numbers 485 and 486 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

**Quiz 485**

<table>
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<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>

**Quiz 486**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>
**Interior and exterior angles in polygons**

**Key points**

- The sum of the **exterior** angles in any polygon is 360°.
- The sum of **interior** angles in any polygon can be calculated using the formula \((n - 2) \times 180\) where \(n\) is the number of sides of the polygon.
- An exterior angle and interior angle lie on a straight line and total 180°.

**Examples – Video tutorials**

- OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Angles in polygons

Scan the QR code above with your mobile phone

*or click on the QR code to follow the hyperlink*
Practice

Question 1: Find the missing angle in each irregular polygon

(a) \[70°\] \[45°\] \[x\] \[88°\]
(b) \[84°\] \[153°\] \[131°\] \[108°\] \[x\]
(c) \[120°\] \[130°\] \[110°\] \[100°\] \[135°\] \[x\]

Question 2: Work out the sum of the interior angles for polygons with

(a) 10 sides  
(b) 14 sides  
(c) 20 sides  
(d) 45 sides

Question 3: Work out the number of sides of polygons with these sum of interior angles

(a) 1260°  
(b) 2880°  
(c) 3960°  
(d) 5040°

Question 4: Each of the polygons below are regular. Calculate the size of each interior angle, x.

(a) regular pentagon  
(b) regular hexagon  
(c) regular octagon

Question 7: Calculate the size of each exterior angle in regular polygons with

(a) 15 sides  
(b) 18 sides  
(c) 20 sides  
(d) 24 sides

Question 8: Shown below is one interior angle from regular polygons. Calculate how many sides the polygons have.

(a) \[144°\]  
(b) \[175°\]  
(c) \[178°\]

Extend

Question 6: A polygon has an interior angle that is five times larger than the exterior angle. How many sides does it have?
Answers

Question 1:
(a) 157°   (b) 67°   (c) 125°

Question 2:
(a) 1440°   (b) 2160°   (c) 3240°   (d) 7740°

Question 3:
(a) 9 sides   (b) 18 sides   (c) 24 sides   (d) 30 sides

Question 4:
(a) 108°   (b) 120°   (c) 135°

Question 7
(a) 24°   (b) 20°   (c) 18°   (d) 15°

Question 8
(a) 10 sides   (b) 72 sides   (c) 180 sides

Question 6: 12 sides

Progress check

You should now complete quiz numbers 561 and 563 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

Quiz 561

<table>
<thead>
<tr>
<th>Score:</th>
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</thead>
<tbody>
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</table>

Date completed:

Quiz 563

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<th>%</th>
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</thead>
<tbody>
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<td></td>
</tr>
</tbody>
</table>

Date completed:
Instructions

- Complete the 30 questions below. You have **20 minutes maximum**.
- Time yourself. See how long it takes you to complete all of the questions.
- Ask your parent or sibling to check your answers when you are finished.
- Record your score and time taken to complete all 30 questions below.

### Skills challenge 7
(Numeracy Ninjas)

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4 + □ = 5</td>
</tr>
<tr>
<td>2</td>
<td>99 + □ = 100</td>
</tr>
<tr>
<td>3</td>
<td>What is half of 99?</td>
</tr>
<tr>
<td>4</td>
<td>152 - 10 = □</td>
</tr>
<tr>
<td>5</td>
<td>104 + □ = 110</td>
</tr>
<tr>
<td>6</td>
<td>122 ÷ 82 = □</td>
</tr>
<tr>
<td>7</td>
<td>5970 - 5961 = □</td>
</tr>
<tr>
<td>8</td>
<td>5 × 8 = 40, so 40 ÷ 5 = □</td>
</tr>
<tr>
<td>9</td>
<td>What is 11:19 am in 24 hour clock format?</td>
</tr>
<tr>
<td>10</td>
<td>What time was it 25 minutes before 22:12?</td>
</tr>
</tbody>
</table>

**Total out of 10**

### Timetables - do these in your head

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>□ + 6 = 7</td>
</tr>
<tr>
<td>2</td>
<td>□ + 10 = 5</td>
</tr>
<tr>
<td>3</td>
<td>36 ÷ □ = 9</td>
</tr>
<tr>
<td>4</td>
<td>2 × □ = 4</td>
</tr>
<tr>
<td>5</td>
<td>6 × □ = 60</td>
</tr>
<tr>
<td>6</td>
<td>□ + 5 = □</td>
</tr>
<tr>
<td>7</td>
<td>□ × 10 = 30</td>
</tr>
<tr>
<td>8</td>
<td>□ × 7 = 42</td>
</tr>
<tr>
<td>9</td>
<td>□ × 8 = 64</td>
</tr>
<tr>
<td>10</td>
<td>21 ÷ 3 = □</td>
</tr>
</tbody>
</table>

**Total out of 10**

### Key Skills - you may use written calculations for these questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>172 × 91 = □</td>
</tr>
<tr>
<td>2</td>
<td>1081 - 853</td>
</tr>
<tr>
<td>3</td>
<td>Write 7389036 in words. Use the opposite page for your answer</td>
</tr>
<tr>
<td>4</td>
<td>52.02 ÷ 10</td>
</tr>
<tr>
<td>5</td>
<td>10 × (−6)</td>
</tr>
<tr>
<td>6</td>
<td>Round 54.7161 to 1 decimal place</td>
</tr>
<tr>
<td>7</td>
<td>(−9) + (−4)</td>
</tr>
<tr>
<td>8</td>
<td>Round 0.8652 to 1 s.f.</td>
</tr>
<tr>
<td>9</td>
<td>What is the letter at (0,2)?</td>
</tr>
<tr>
<td>10</td>
<td>What is 5/7 of 56?</td>
</tr>
</tbody>
</table>

**Total out of 10**

Score: / 30

Time taken: :
Solving linear equations with unknown on one side

Key points

- When solving equations, we are trying to find the value of the unknown which is represented by a letter, such as $x$.
- Our goal is to isolate the unknown on one side of the equation.
- We use a ‘balancing’ method to solve equations, doing the ‘same to both sides’. For example, if we subtract 3 from one side of the equation, we subtract 3 from the other side to keep it balanced.

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Solving linear equations

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Solve the following equations

(a) \( w + 5 = 7 \)  
(b) \( c + 2 = 10 \)  
(c) \( a - 1 = 6 \)  
(d) \( x - 4 = 5 \)

(e) \( x + 4 = 13 \)  
(f) \( 3w = 12 \)  
(g) \( 2x = 18 \)  
(h) \( \frac{w}{2} = 6 \)

(i) \( \frac{x}{4} = 7 \)  
(j) \( 5y = 30 \)  
(k) \( x + 10 = 40 \)  
(l) \( 2x = 34 \)

Question 2: Solve the following equations

(a) \( 2x + 3 = 9 \)  
(b) \( 3w - 1 = 14 \)  
(c) \( 7y + 2 = 30 \)

(d) \( 5x + 20 = 35 \)  
(e) \( 6c - 12 = 48 \)  
(f) \( 8m - 4 = 20 \)

(g) \( 7w + 13 = 90 \)  
(h) \( 12p - 18 = 30 \)  
(i) \( 9w - 5 = 67 \)

Question 4: Solve the following equations

(a) \( \frac{x + 1}{2} = 9 \)  
(b) \( \frac{x - 3}{4} = 8 \)  
(c) \( \frac{m - 8}{5} = 3 \)

(d) \( \frac{2x}{3} = 6 \)  
(e) \( \frac{3x}{5} = 30 \)  
(f) \( \frac{5x}{4} = 20 \)

Extend

Question 5: A rectangular field has a perimeter of 150m.
The field is 15 metres longer than it is wide.
The width of the field is \( x \) metres.

(a) Write down an equation for this information.
(b) Solve your equation to find the width of the field
(c) Find the length of the field

Question 6: Shown is a triangle.
The three angles add up to give 180°

(a) Write down an equation for this information
(b) Solve your equation to find \( x \).
Answers

Question 1
(a) w = 2  (b) c = 8  (c) a = 7
(d) x = 9  (e) x = 9  (f) w = 4
(g) x = 9  (h) w = 12  (i) x = 28
(j) y = 6  (k) x = 30  (l) x = 17
(m) x = 16  (n) m = 48  (o) w = 50
(p) x = 50  (q) y = 5  (r) x = 5.5
(s) b = -2  (t) x = 4.5  (u) y = 2.5
(v) g = 3.7  (w) a = 4  (x) v = -8
(y) w = 10.8  (z) y = 4.8

Question 2
(a) x = 3  (b) w = 5  (c) y = 4
(d) x = 3  (e) c = 10  (f) m = 3
(g) w = 11  (h) p = 4  (i) I = 8
(j) a = 6  (k) x = 12  (l) w = 0
(m) x = 4  (n) w = 13  (o) x = 12
(p) c = 20  (q) x = 60  (r) n = 81
(s) x = 84  (t) c = 96  (u) x = 225

Question 4
(a) x = 17  (b) x = 35  (c) m = 23
(d) x = 9  (e) x = 50  (f) x = 16

Question 5) (a) 4x + 30 = 150  (b) x = 30  (c) 45 metres

Question 6) (a) 3x + 63 = 180  (b) x = 39
Progress check

You should now complete **quiz numbers 179 and 180** on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

**Quiz 179**

<table>
<thead>
<tr>
<th>Score:</th>
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</thead>
</table>

**Quiz 180**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>
Solving equations with unknown on both sides

Key points

- When solving equations, we are trying to find the value of the unknown which is represented by a letter (called a 'variable'), such as $x$.
- Our goal is to first isolate the unknowns on one side of the equation.
- We use a 'balancing' method to solve equations by doing the 'same to both sides'. For example, if we subtract $3y$ from one side of the equation, we subtract $3y$ from the other side to keep it balanced.

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Ununknowns on both sides

Scan the QR code above using your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Solve the following equations

(a) \(4x + 1 = 2x + 7\)  
(b) \(5x + 4 = 3x + 16\)  
(c) \(2x + 8 = x + 12\)

(d) \(7x + 1 = 2x + 46\)  
(e) \(6x - 3 = 2x + 13\)  
(f) \(9x - 10 = 7x + 24\)

(g) \(2x + 21 = 4x + 5\)  
(h) \(x + 2 = 5x - 2\)  
(i) \(6x - 9 = 4x - 1\)

Question 2: Solve the following equations

(a) \(3x + 3 = x + 8\)  
(b) \(9x + 10 = 7x + 39\)  
(c) \(3x + 1 = 7x - 17\)

(d) \(x + 4 = 13 - x\)  
(e) \(16x + 3 = 6x + 24\)  
(f) \(9x + 12 = 6x + 14\)

Question 3: Solve the following equations

(a) \(4x + 15 = x + 3\)  
(b) \(8x + 40 = 3x + 5\)  
(c) \(9x + 7 = 11x + 20\)

(d) \(7x + 9 = 2x - 16\)  
(e) \(9x - 70 = 2x - 91\)  
(f) \(4 - 5x = 3x + 28\)

Question 4: Solve the following equations

(a) \(5(x + 3) = 3(x + 9)\)  
(b) \(8(x - 1) = 4(x + 3)\)  
(c) \(3(x + 13) = 10(x - 1)\)

(d) \(2(4x - 3) = 5(2x - 5)\)  
(e) \(9(2x - 5) = 3(4x + 7)\)  
(f) \(2(9 - x) = 3(x + 16)\)

Extend

Question 1: Shown is a rectangle

(a) Explain why \(9x + 12 = 4x + 47\)

(b) Find x

\[\text{9x + 12} \quad \text{4x + 47}\]

Question 2: Shown is an isosceles triangle

(a) Explain why \(4x + 15 = 33 - 2x\)

(b) Find x

(c) Find the perimeter of the isosceles triangle

\[\text{4x + 15} \quad \text{33 - 2x} \quad \text{5x}\]
Answers

Question 1:
(a) $x = 3$  
(b) $x = 6$  
(c) $x = 4$  
(d) $x = 9$
(e) $x = 4$  
(f) $x = 17$  
(g) $x = 8$  
(h) $x = 1$  
(i) $x = 4$

Question 2:
(a) $x = 2.5$  
(b) $x = 14.5$  
(c) $x = 4.5$  
(d) $x = 4.5$
(e) $x = 2.1$  
(f) $x = \frac{2}{3}$

Question 3:
(a) $x = -4$  
(b) $x = -7$  
(c) $x = -6.5$  
(d) $x = -5$
(e) $x = -3$  
(f) $x = -3$

Question 4:
(a) $x = 6$  
(b) $x = 5$  
(c) $x = 7$  
(d) $x = 9.5$
(e) $x = 11$  
(f) $x = -6$

Question 1:
(a) The opposite sides of a rectangle have the same length
(b) $x = 7$

Question 2:
(a) In an isosceles triangle there are two sides of equal length
(b) $x = 3$
Progress check

You should now complete quiz numbers **184, 185 and 186** on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

**Quiz 184**

<table>
<thead>
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**Quiz 185**

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**Quiz 186**

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Skills challenge 8
(Numeracy Ninjas)

Instructions

• Complete the 30 questions below. You have **20 minutes maximum**.
• Time yourself. See how long it takes you to complete all of the questions.
• Ask your parent or sibling to check your answers when you are finished.
• Record your score and time taken to complete all 30 questions below.

<table>
<thead>
<tr>
<th>MENTAL STRATEGIES - do these in your head</th>
<th>TIMETABLES - do these in your head</th>
<th>KEY SKILLS - you may use written calculations for these questions</th>
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</thead>
<tbody>
<tr>
<td>Q</td>
<td>Question</td>
<td>Answer</td>
</tr>
<tr>
<td>1</td>
<td>$6 + \Box = 10$</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>What is double 8?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>What is half of 76?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$177 + 20 = \Box$</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$93 + 90 = \Box$</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>$15 + 14 = 15 + \Box$</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>$5 + 740 = \Box$</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>$73 + 15 = 73 + 10 + \Box$</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Draw hands on the clock face showing 1:40 pm</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>What is 16:29 in 12 hour clock format?</td>
<td></td>
</tr>
</tbody>
</table>

Total out of 10

Total out of 10

Score: 30

Time taken:  
**Solving inequalities**

Key points

- We can write inequalities using the following symbols:
  - < which means ‘greater than’
  - > which means ‘less than’
  - ≤ which means ‘greater than or equal to’
  - ≥ which means ‘less than or equal to’

- We can solve inequalities in the same way we solve equations, using the balancing method to isolate the variable

- Where there are three expressions set up in an inequality the balancing method applies to each expression

- When there is a negative variable, use balancing to remove the negative e.g. if there is -3y in the inequality, add +3y to both sides of the inequality

Examples – Video tutorials

**CLIP NUMBERS: 269, 270, 271 & 272**

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Solving inequalities

Scan the QR code above using your mobile phone

*or click on the QR code to follow the hyperlink*
Practice

Question 1: Solve each of the inequalities below
(a) \( x + 4 > 9 \) \hspace{1cm} (b) \( x - 3 < 2 \) \hspace{1cm} (c) \( 2x \leq 14 \) \hspace{1cm} (d) \( 8x < 16 \)
(e) \( 5x \geq 15 \) \hspace{1cm} (f) \( \frac{x}{3} > 4 \) \hspace{1cm} (g) \( \frac{x}{5} \leq 2 \) \hspace{1cm} (h) \( x + 6 \geq 4 \)

Question 2: Solve each of the inequalities below
(a) \( 2x + 1 \leq 9 \) \hspace{1cm} (b) \( 3x - 5 > 16 \) \hspace{1cm} (c) \( 4x + 8 < 32 \) \hspace{1cm} (d) \( 5x - 2 \geq 68 \)
(e) \( \frac{x}{2} + 1 \leq 5 \) \hspace{1cm} (f) \( \frac{x}{9} - 6 > 4 \) \hspace{1cm} (g) \( \frac{x + 3}{2} \geq 5 \) \hspace{1cm} (h) \( \frac{x - 5}{4} > 2 \)

Question 5: Solve each of the inequalities below
(a) \( 4x + 3 > 2x + 11 \) \hspace{1cm} (b) \( x + 1 \geq 3x - 18 \)
(c) \( 13x - 12 < 3x + 13 \) \hspace{1cm} (d) \( 7x - 5 \geq 3x + 11 \)

Question 8: Solve each of the inequalities below
(a) \( 6 < x + 3 < 10 \) \hspace{1cm} (b) \( 4 \leq 2x \leq 7 \) \hspace{1cm} (c) \( 1 \leq 3x < 9 \)
(d) \( 4 < \frac{x}{5} < 6 \) \hspace{1cm} (e) \( 9 \leq 2x + 3 \leq 25 \) \hspace{1cm} (f) \( -3 \leq \frac{x}{4} - 1 < 0 \)

Extend

Question 1: Lauren goes shopping and has £50 to spend. She bought a T-shirt and 3 pairs of leggings. The T-shirt cost £23. Each pair of leggings cost £x.

(a) Form an inequality in terms of x.
(b) Solve the inequality to find the possible price of the leggings.

Question 3: The perimeter of the regular pentagon is larger than the perimeter of the equilateral triangle.

(a) Form an inequality in terms of x

(b) Solve the inequality to find the possible range of values for x.
Answers

Question 1:
(a) \( x > 5 \)  \hspace{1cm} (b) \( x < 5 \)  \hspace{1cm} (c) \( x \leq 7 \)  \hspace{1cm} (d) \( x < 2 \)
(e) \( x \geq 3 \)  \hspace{1cm} (f) \( x > 12 \)  \hspace{1cm} (g) \( x \leq 10 \)  \hspace{1cm} (h) \( x \geq -2 \)

Question 2:
(a) \( x \leq 4 \)  \hspace{1cm} (b) \( x > 7 \)  \hspace{1cm} (c) \( x < 6 \)  \hspace{1cm} (d) \( x \geq 14 \)
(e) \( x \leq 8 \)  \hspace{1cm} (f) \( x > 90 \)  \hspace{1cm} (g) \( x \geq 7 \)  \hspace{1cm} (h) \( x > 13 \)

Question 5:
(a) \( x > 4 \)  \hspace{1cm} (b) \( 9.5 \geq x \)  \hspace{1cm} (c) \( x < 2.5 \)  \hspace{1cm} (d) \( x \geq 4 \)

Question 8:
(a) \( 3 < x < 7 \)  \hspace{1cm} (b) \( 2 \leq x \leq 3.5 \)  \hspace{1cm} (c) \( \frac{1}{3} \leq x \leq 3 \)  \hspace{1cm} (d) \( 20 < x < 30 \)
(e) \( 3 \leq x \leq 11 \)  \hspace{1cm} (f) \( -8 \leq x < 4 \)

Question 1: (a) \( 23 + 3x \leq 50 \)  \hspace{1cm} (b) \( x \leq £9 \)

Question 3: (a) \( 5(x+2) > 3(x+6) \)  \hspace{1cm} (b) \( x > 4 \)

Progress check
You should now complete **quiz numbers 269, 270, 271 and 272** on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

**Quiz 269**

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**Quiz 270**

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**Quiz 271**

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**Quiz 272**

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</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date completed:
Representing inequalities of a number line

Key points

- Inequalities can be represented on a number line using a combination of dots and lines
- \(<\) and \(>\) are represented with an unshaded circle i.e. \(\circ\)
- \(\geq\) and \(\leq\) are represented with a shaded circle i.e. \(\bullet\)

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Inequalities on a number line

Scan the QR code above using your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 4: Write down the inequalities shown below

(a) \[ x > 2 \]  
(b) \[ x < 4 \]  
(c) \[ x \geq 3 \]  
(d) \[ x \leq 5 \]  
(e) \[ x \geq 0 \]  
(f) \[ x \leq -1 \]  
(g) \[ x < -4 \]  
(h) \[ x > -5 \]  

Question 9: Write down the inequalities shown below

(a) \[ x < -1 \]  
(b) \[ x > 5 \]  
(c) \[ x \geq -1 \]  
(d) \[ x \leq 5 \]  
(e) \[ x > 2 \]  
(f) \[ x < 4 \]  

Extend

Question 5: Write down any integers (whole numbers) that satisfies both \( x > 4 \) and \( x \leq 8 \)

Question 6: Write down any integers (whole numbers) that satisfies both \( 2 < x \leq 9 \) and \( x > 5 \)
Answers

Question 4:
(a) $x > 1$    (b) $x < 3$    (c) $x \leq 5$    (d) $x \geq 0$
(e) $x \geq -2$    (f) $x < -3$    (g) $x > -5$    (h) $x \leq 0$

Question 5:

Question 9:
(a) $1 < x < 4$    (b) $0 < x < 5$    (c) $0 < x \leq 3$
(d) $-3 \leq x \leq 4$    (e) $-5 \leq x < -1$    (f) $-3 < x \leq 4$

Extend

Question 5: 5, 6, 7, 8

Question 6: 6, 7, 8, 9
Progress check

You should now complete quiz numbers 265 and 266 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

**Quiz 265**

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**Quiz 266**

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</table>
**Skills challenge 9**

**(Numeracy Ninjas)**

**Instructions**

- Complete the 30 questions below. You have **20 minutes maximum**.
- Time yourself. See how long it takes you to complete all of the questions.
- Ask your parent or sibling to check your answers when you are finished.
- Record your score and time taken to complete all 30 questions below.

<table>
<thead>
<tr>
<th>MENTAL STRATEGIES - do these in your head</th>
<th>TIMETABLES - do these in your head</th>
<th>KEY SKILLS - you may use written calculations for these questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Q</strong></td>
<td><strong>Question</strong></td>
<td><strong>Answer</strong></td>
</tr>
<tr>
<td>1</td>
<td>$20 = \square + 13$</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Double 60</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$93 + 10 = \square$</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$84 - 40 = \square$</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$4 = 2 + \square$</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>$55 - 6 = 55 - 5 - \square$</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>$\square \times 2 - 2 + 2 + 2$</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>$71 + 49 = 71 + 40 + \square$</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>Draw hands on the clock face showing 9:35 am</strong></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><strong>What time will it be 59 minutes after 21:04?</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Total out of 10**

**Score:** / 30

**Time taken:** :
Drawing quadratic graphs

Key points

- Quadratic functions always have $x^2$ as the highest power of $x$.
- The graphs of quadratic functions are always the same shape, called a **parabola**.
- If the coefficient of $x^2$ is **positive**, the parabola is u-shaped.
- If the coefficient of $x^2$ is **negative**, the parabola is n-shaped.
- To draw the graph we need **coordinates**, generate these by **substituting** values into the quadratic equation.
- Ensure you join the points with a smooth curve.

Examples – Video tutorials

**OR**

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Drawing quadratic graphs

Scan the QR code above using your mobile phone

*or click on the QR code to follow the hyperlink*
Practice

Question 1:
(a) Complete the table of values for \( y = x^2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>-1</td>
<td>-4</td>
</tr>
</tbody>
</table>

(b) On the grid, draw the graph of \( y = x^2 \) for the values of \( x \) from \(-2\) to \(2\)

Question 2:
(a) Complete the table of values for \( y = x^2 + 3 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) On the grid, draw the graph of \( y = x^2 + 3 \) for the values of \( x \) from \(-2\) to \(2\)

Question 3:
(a) Complete the table of values for \( y = x^2 - 2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) On the grid, draw the graph of \( y = x^2 - 2 \) for the values of \( x \) from \(-2\) to \(2\)
Question 6:

(a) Complete the table of values for \( y = x^2 + x - 4 \)

<table>
<thead>
<tr>
<th>( x )</th>
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<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) On the grid, draw the graph of \( y = x^2 + x - 4 \) for the values of \( x \) from -2 to 3

Question 7:

(a) Complete the table of values for \( y = x^2 - 3x + 2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>( y )</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) On the grid, draw the graph of \( y = x^2 - 3x + 2 \) for the values of \( x \) from -2 to 3

Extend

Question 1:

(a) Complete a table of values for \( y = (x - 1)(x - 2) \) for the values of \( x \) from -2 to 3

(b) Complete a table of values for \( y = (3 - x)(x + 1) \) for the values of \( x \) from -2 to 3

(c) Draw both graphs on the grid for the values of \( x \) from -2 to 3
Answers

Question 1
(a)

(b)

Question 2
(a)

(b)
Question 3

(a)

<table>
<thead>
<tr>
<th>x</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
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<tbody>
<tr>
<td>y</td>
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<td>-1</td>
<td>-2</td>
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<td>2</td>
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(b)

[Graph image]

Question 6

(a)

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<th>3</th>
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<tbody>
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<td>-4</td>
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<td>8</td>
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</table>

(b)

[Graph image]
Question 7
(a)  
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<td>0</td>
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</table>

(b)  

(c)  

Question 1
(a)  
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<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
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<td>6</td>
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<td>0</td>
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</table>

(b)  
<table>
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<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>-5</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>
Progress check

You should now complete **quiz number 251** on Hegarty Maths to show your teacher that you have understood this topic

Record your percentage score below:

**Quiz 251**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
</tr>
</thead>
</table>

| Date completed: |   |
Sample space diagrams

Key points

- A sample space diagram is a table used to show all the possible outcomes when two events are carried out. For example, rolling a two dice or spinning two spinners.
- We can use a sample space diagram to calculate the probability of an outcome. For sample, the chance of getting a total of 8 on two die when they are rolled.

Examples – Video tutorials

CLIP NUMBERS: 359

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Sample space diagrams

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Two fair six sided dice are rolled.
The numbers on the two dice are added together to give a score.
The table shows all possible scores.

(a) Which score is the most likely?

(b) Which scores are the least likely?

(c) Write down the probability of scoring a
   (i) 3   (ii) 5   (iii) 6   (iv) 7

(d) Write down the probability of scoring a number
   (i) over 10   (ii) under 7   (iii) 4 or less   (iv) 6 or more

(e) Write down the probability of scoring
   (i) an odd number   (ii) a square number   (iii) a prime number

Question 2: Two fair six sided dice are rolled.
The numbers on the two dice are multiplied together to give a score.

(a) Complete the table to show all possible scores.

(b) Write down the probability
   (i) 10   (ii) 9   (iii) 12   (iv) 8

(c) Write down the probability of scoring
   (i) an even number   (ii) an odd number
   (iii) a number less than 20

Question 4: Rose is playing a game with a fair six sided dice and a fair coin.
She rolls the dice and flips the coin.

If the coin lands on heads, her score is one less than the number on the dice.
If the coin lands on tails, her score is two more than the number on the dice

(a) Complete the table to show all possible scores

(b) Find the probability of scoring a 0

(c) Find the probability of scoring a 5

(d) Find the probability of scoring a number less than 4

(e) Find the probability of scoring a square number
Extend

Question 5: A fair dice has six faces numbered 1, 1, 2, 3 and 4. The dice is rolled twice and the number shown is recorded each time. Find the probability that the sum of the two numbers recorded is at least 4.

Question 6: A fair six sided dice is rolled twice. Find the probability that the number obtained on the first roll is at least 3 greater than the second roll

Answers

Question 1:

(a) 7

(b) 2 and 12

(c) (i) 2/36 (1/18) (ii) 4/36 (1/9) (iii) 5/36 (iv) 6/36 (1/6)

(d) (i) 3/36 (1/12) (ii) 15/36 (5/12) (iii) 6/36 (1/6) (iv) 26/36 (13/18)

(e) (i) 18/36 (1/2) (ii) 7/36 (iii) 15/36 (5/12)

Question 2 (a):

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
</tr>
</tbody>
</table>

2(b): (i) 2/36 (1/18) (ii) 1/36 (iii) 4/36 (1/9) (iv) 2/36 (1/18)

(c) (i) 27/36 (3/4) (ii) 9/36 (1/4) (iii) 28/36 (7/9)
Progress check

You should now complete quiz number 359 on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage score below:

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>

Question 4(a):

(b) 1/12
(c) 2/12 (1/6)
(d) 5/12
(e) 3/12

Question 5: 21/36 (7/12)

Question 6: 6/36 (1/6)
Skills challenge 10
(Numeracy Ninjas)

Instructions

- Complete the 30 questions below. You have 20 minutes maximum.
- Time yourself. See how long it takes you to complete all of the questions.
- Ask your parent or sibling to check your answers when you are finished.
- Record your score and time taken to complete all 30 questions below.

<table>
<thead>
<tr>
<th>MENTAL STRATEGIES - do these in your head</th>
<th>TIMETABLES - do these in your head</th>
<th>KEY SKILLS - you may use written calculations for these questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>Question</td>
<td>Answer</td>
</tr>
<tr>
<td>1</td>
<td>$5 - 1 + \square$</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$100 = \square + 49$</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Halve 3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$165 - 10 = \square$</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$169 + \square = 170$</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>$43 = 20 + \square$</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>$7191 - 7184 = \square$</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>$7 \times 6 = 42$, so $42 + 6 = \square$</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>What is 5:00 am in 24 hour clock format?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>What time was it 45 minutes before 10:57 pm?</td>
<td></td>
</tr>
</tbody>
</table>

| Total out of 10 | Total out of 10 |  |

Score: / 30 Time taken: : 

89
Key points

- Data that is collected can often be from more than one category.
- Two-way tables are a way of sorting data so that the frequency of each category can be seen quickly and easily.

Examples – Video tutorials

CLIP NUMBER: 422, 423 & 424

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Two-way tables

Scan the QR code above using your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 2: 50 children were asked if they wanted to go bowling or to the cinema.

17 girls and 11 boys wanted to go bowling.
12 boys wanted to go to the cinema.

(a) Use this information to complete the two-way table below.

<table>
<thead>
<tr>
<th></th>
<th>Bowling</th>
<th>Cinema</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) How many children, in total, want to go to the cinema?

Question 3: Complete the following two way tables:

(a) | Car | Bus | Walk | Total |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 9</td>
<td>10</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>Year 10</td>
<td>7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td></td>
<td>42</td>
</tr>
</tbody>
</table>

(b) | English | Art | Total |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Fail</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>

(c) | Rugby | Football | Hockey | Total |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 9A</td>
<td>7</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Class 9B</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

(d) | Child | Adult | Total |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Question 4: This two-way table shows the number of goals scored in each match by three football teams throughout January, February and March.

<table>
<thead>
<tr>
<th></th>
<th>Rovers</th>
<th>City</th>
<th>United</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 goals</td>
<td>8</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>1 goal</td>
<td>3</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>2 or more</td>
<td>7</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>

(a) Find the number of matches that Rovers played.
(b) Find the number of matches where 1 goal was scored by these teams.
(c) In what percentage of their matches did City score no goals?
(d) Find the fraction of United’s matches where they scored 2 or more goals.

Extend

Question 1: Paul has a deck of 50 cards, each with a shape on it. The shapes are either red or black.

<table>
<thead>
<tr>
<th></th>
<th>Square</th>
<th>Rectangle</th>
<th>Kite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>17</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Black</td>
<td>4</td>
<td>9</td>
<td>13</td>
</tr>
</tbody>
</table>

Paul picks a card at random.

(a) What is the probability that the card has a black kite on it?
(b) What is the probability that the card has a red shape on it?
(c) What is the probability that the card has a square on it?
(d) What is the probability that the card has a shape with at least 2 lines of symmetry?

Question 2: 60 people visited a swimming pool one evening. 13 out of the 19 people who wore goggles were adults. There were 15 children.

(a) Complete a two-way table for this information.
(b) How many adults did not wear goggles?
(c) What fraction of the children wore goggles?
Question 3: 100 families booked a holiday in July or in August, at a travel agents. Some of the families booked to go to France. Some booked to go to Spain. The rest of the families booked a holiday to Portugal.  
59 families booked to go on holiday in August.  
19 of the 35 families going to France booked to go in July.  
30 families booked to go to Portugal.  
20 families booked to go to Spain in August.  

(a) Create a two-way table for this information.  
(b) How many families booked to go to Portugal in July?  

Question 4: There are 120 students in Year 11 at a school. Each student studies one language, either French, Spanish, German or Welsh.  
21 of the 40 students studying Welsh are male.  
18 males and 9 females study French.  
12 of the 17 students studying Spanish are female. Twice as many females study German than males.  

How many students in Year 11 are female?  

Question 5: A teacher surveys 64 children on how they travelled to school.  
20 of the students were in Year 7.  
The teacher surveyed 30% more students in Year 9 than in Year 7.  
The rest of the students surveyed were in Year 11.  
75% of the students in Year 7 walked to school.  
8 more students in Year 9 walked to school than did not walk.  
Out of students surveyed, more Year 11 students walked to school than Year 9 students.  

One of these students is picked at random  

Write down the probability that the student chosen will walk to school.  

Answers
Question 2:

(a)

<table>
<thead>
<tr>
<th></th>
<th>Bowling</th>
<th>Cinema</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>11</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>Girls</td>
<td>17</td>
<td>10</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>22</td>
<td>50</td>
</tr>
</tbody>
</table>

(b) 22

Question 3:

(a)

<table>
<thead>
<tr>
<th></th>
<th>Car</th>
<th>Bus</th>
<th>Walk</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 9</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Year 10</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>15</td>
<td>11</td>
<td>42</td>
</tr>
</tbody>
</table>

(b)

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>Art</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>25</td>
<td>7</td>
<td>32</td>
</tr>
<tr>
<td>Fail</td>
<td>1</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>19</td>
<td>45</td>
</tr>
</tbody>
</table>

(c)

<table>
<thead>
<tr>
<th></th>
<th>Rugby</th>
<th>Football</th>
<th>Hockey</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 9A</td>
<td>7</td>
<td>11</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Class 9B</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>14</td>
<td>14</td>
<td>40</td>
</tr>
</tbody>
</table>

(d)

<table>
<thead>
<tr>
<th></th>
<th>Child</th>
<th>Adult</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>52</td>
<td>34</td>
<td>86</td>
</tr>
<tr>
<td>Female</td>
<td>49</td>
<td>43</td>
<td>92</td>
</tr>
<tr>
<td>Total</td>
<td>101</td>
<td>77</td>
<td>178</td>
</tr>
</tbody>
</table>

Question 4

(a) 18

(b) 20

(c) 15%

(d) \(\frac{13}{18}\)
Extend Answers

Question 1:

(a) \[
\frac{13}{50}
\]

(b) \[
\frac{12}{25}
\]

(c) \[
\frac{21}{50}
\]

(d) \[
\frac{18}{25}
\]

Question 2:

(a)

<table>
<thead>
<tr>
<th></th>
<th>Goggles</th>
<th>No Goggles</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td>13</td>
<td>32</td>
<td>45</td>
</tr>
<tr>
<td>Child</td>
<td>6</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>41</td>
<td>60</td>
</tr>
</tbody>
</table>

(b) \[
32
\]

(c) \[
\frac{2}{5}
\]

Question 3:

(a)

<table>
<thead>
<tr>
<th></th>
<th>France</th>
<th>Spain</th>
<th>Portugal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>19</td>
<td>15</td>
<td>7</td>
<td>41</td>
</tr>
<tr>
<td>Aug</td>
<td>16</td>
<td>20</td>
<td>23</td>
<td>59</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>35</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

(b) 7 families

Question 4:

64 students are female in Year 11

<table>
<thead>
<tr>
<th></th>
<th>French</th>
<th>Spanish</th>
<th>German</th>
<th>Welsh</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>18</td>
<td>5</td>
<td>12</td>
<td>21</td>
<td>56</td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>12</td>
<td>24</td>
<td>19</td>
<td>64</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>17</td>
<td>36</td>
<td>40</td>
<td>120</td>
</tr>
</tbody>
</table>

Question 5:

\[
\frac{25}{32}
\]
Progress check

You should now complete **quiz numbers 422, 423 and 424** on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

**Quiz 422**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>

**Quiz 423**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>

**Quiz 424**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>
Frequency trees

Key points

- A frequency tree is used to display how a group of people or items can be divided up into various categories. For example, how a school can be divided into students/teachers and by gender.
- Unlike probability trees, we used ‘frequencies’ on the frequency trees which means we use actual quantities as opposed to probabilities as fractions or decimals.
- We can use a frequency tree to calculate missing quantities or probabilities.

Examples – Video tutorials

OR

If you do not have access to Hegarty Maths, you can use the Corbett maths videos below

Frequency trees

Scan the QR code above with your mobile phone

or click on the QR code to follow the hyperlink
Practice

Question 1: Complete the following frequency trees.

(a)

(b)

Question 4: 200 students were given some homework.
102 of these students are in Year 11.
182 of the 200 students did their homework
14 of the Year 10 students did not do their homework.

(a) Complete the frequency tree.
(b) What percentage of students in Year 11 did their homework?

Question 6: In Year 9 there are 95 students.
46 of the 50 girls are right handed.
There are 9 left handed boys.

(a) Show this information on a frequency tree
(b) What fraction of the boys are right handed?
(c) What fraction of the students are left handed?

A left handed student is picked at random.
(d) Write down the probability that this student is a girl.
Extend

Question 7:  In a school, all 135 students study one language.

Twice as many students study German than Spanish.
5 more students study Spanish than French.
10 more females than males study German.
60% of the students studying French are male.
16 males study Spanish.

How many of the students are female?

Answers

Question 1:  Complete the following frequency trees.

(a)

(b)

Question 4:  200 students were given some homework.

102 of these students are in Year 11.
182 of the 200 students did their homework
14 of the Year 10 students did not do their homework.

(a) Complete the frequency tree.

(b) What percentage of students in Year 11 did their homework? 

\[ 46.08\% \]

Question 6:  In Year 9 there are 95 students.
46 of the 50 girls are right handed.
There are 9 left handed boys.

(a) Show this information on a frequency tree

(b) What fraction of the boys are right handed?

(c) What fraction of the students are left handed?

A left handed student is picked at random.

(d) Write down the probability that this student is a girl. 

\[ \frac{9}{13} \]
Progress check

You should now complete **quiz numbers 368 and 369** on Hegarty Maths to show your teacher that you have understood this topic.

Record your percentage scores below:

**Quiz 368**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>

**Quiz 369**

<table>
<thead>
<tr>
<th>Score:</th>
<th>%</th>
<th>Date completed:</th>
</tr>
</thead>
</table>
**Skills challenge 11**

(Numeracy Ninjas)

**Instructions**
- Complete the 30 questions below. You have **20 minutes maximum**.
- Time yourself. See how long it takes you to complete all of the questions.
- Ask your parent or sibling to check your answers when you are finished.
- Record your score and time taken to complete all 30 questions below.

<table>
<thead>
<tr>
<th>MENTAL STRATEGIES - do these in your head</th>
<th>TIME-tables - do these in your head</th>
<th>KEY SKILLS - you may use written calculations for these questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>Question</td>
<td>Answer</td>
</tr>
<tr>
<td>1</td>
<td>10 = □ + 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>What is double 8?</td>
<td>□</td>
</tr>
<tr>
<td>3</td>
<td>What is half of 51?</td>
<td>□</td>
</tr>
<tr>
<td>4</td>
<td>15 + 80 = □</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>133 – 60 = □</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>12 + □ = 20</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>68 + 70 = □</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>51 + 18 = 51 + 9 + □</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1 + 871 = □</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>86 + 85 = 80 + 80 + □</td>
<td></td>
</tr>
</tbody>
</table>

| Total out of 10 | Total out of 10 | Total out of 10 |

Score: / 30  
Time taken: :