

Okehampton College

Mathematics



Year 9

Summer Term Review

Name:

Higher

Topic 1	Angles in parallel lines and polygons
Topic 2	Percentages
Topic 3	Repeated proportional change
Topic 4	Expanding Brackets
	Answers

This booklet is to be used by the students in
maths groups 9xMa1-3, 9yMa1-3

Introduction – how to use this booklet

This booklet is to help you review and revise the key topics covered towards the end of the academic year (and mostly by remote learning).

Early in the Autumn term you will have a written assessment on questions from these topics and your performance will help your teachers plan how to support you next year.

Each section contains a Knowledge Organiser on the topic, followed by practice questions. The answers are at the end of the booklet.

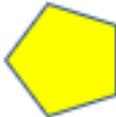
If you have completed most of the remote learning lessons set on Class Charts, you may still like to use this booklet to review what you have learnt and help you prepare for the assessment.

If you have not been able to complete many of the lessons, the knowledge organisers should help you catch up on the topics and answer the practice questions. You should check your work against the answers and if necessary, go back and correct any mistakes.

You will still be able to log in to the Sparx lessons (codes given on Class Charts for your class) until 31st July, so you can still use this resource to catch up on some topics and practise the skills.

**This booklet is to be used by the students in
maths groups 9xMa1-3, 9yMa1-3**

A regular polygon has all equal lengths and all its angles are equal.

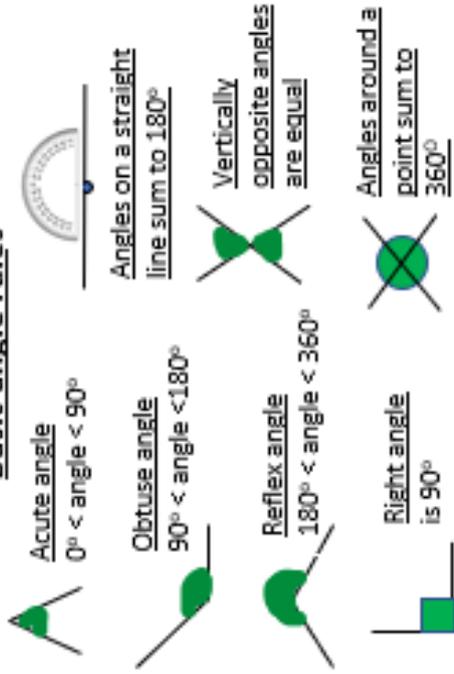


Angles in parallel lines and polygons

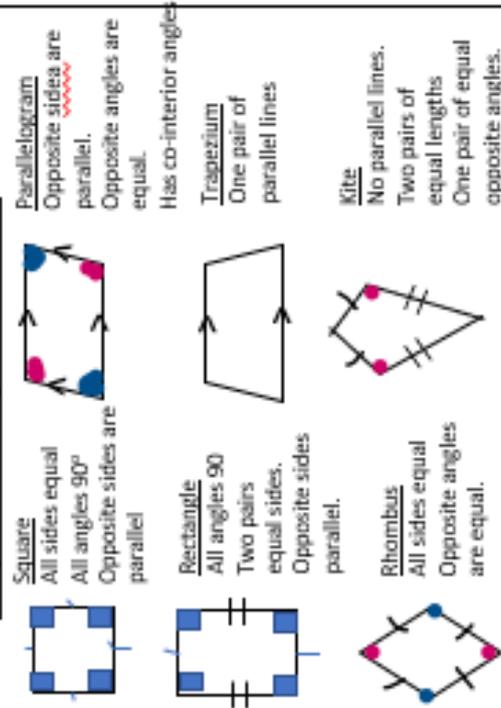
An irregular polygon has sides and angles of different sizes.



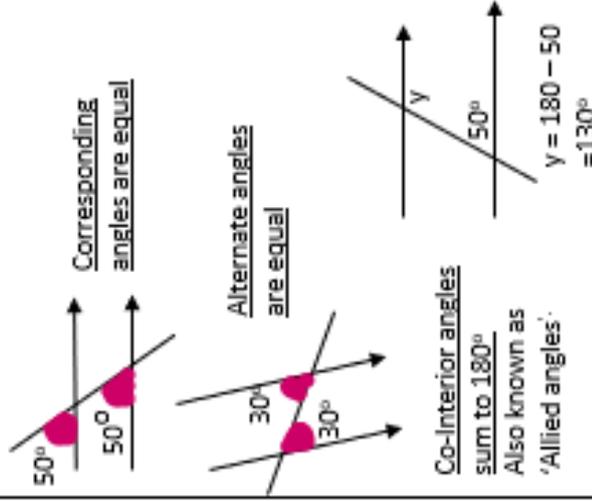
Basic angle rules



Properties of Quadrilaterals



Parallel Lines



Sum of Interior angles = (number of sides - 2) x 180

$$\text{Sum of interior angles} = (5 - 2) \times 180 = 540^\circ$$



Interior angles are enclosed by the polygon



This irregular pentagon can be split up into 3 triangles and each triangle has an angle sum of 180°
Hence $3 \times 180 = 540^\circ$

Sum of exterior angles



An interior angle is adjacent to an exterior angle in all polygons.
Therefore
Interior + exterior = 180°

Exterior angles all add up to 360°

Interior angle in regular polygons

$$= \frac{\text{number of sides} - 2}{\text{number of sides}} \times 180^\circ$$

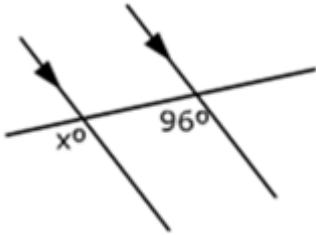
Missing angles in regular polygons

$$\text{Exterior angle in regular polygons} = 360^\circ \div \text{number of sides}$$

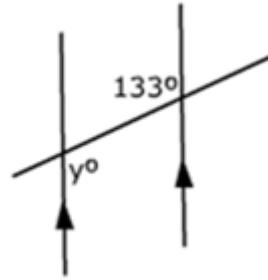
Common polygons	Number of sides	Name
	5	Pentagon
	6	Hexagon
	7	Heptagon
	8	Octagon
	9	Nonagon
	10	Decagon

Year 9 Higher – Angles in parallel lines and polygons

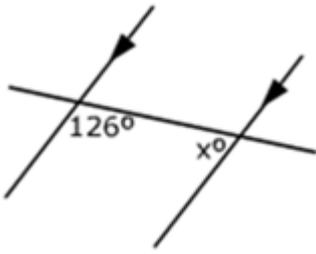
1. Find the missing angle – give a reason for your answer.



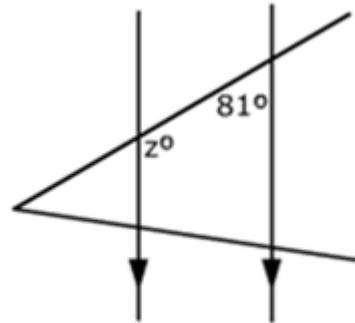
2. Find the missing angle – give a reason for your answer.



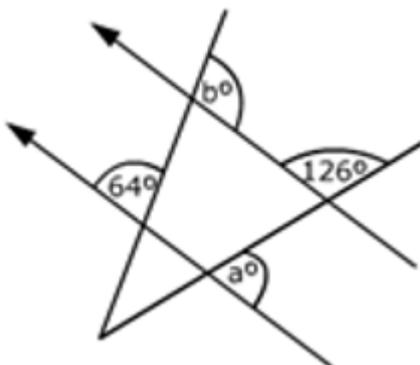
3. Find the missing angle – give a reason for your answer.



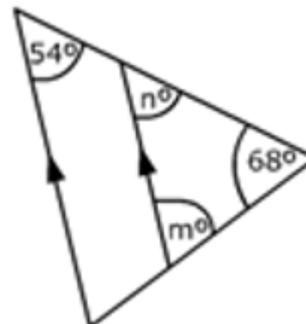
4. Find the missing angle – give a reason for your answer.



5. Find the missing angles – give reasons for your answer.



6. Find the missing angles – give reasons for your answer.



7 Complete the table

Name of regular polygon	Number of Sides	Size of exterior angle	Sum of all interior angles	Size of interior angle
Equilateral triangle	3	$360^\circ \div 3 = \underline{\quad}$	$1 \times 180^\circ = \underline{\quad}$	$\underline{\quad} \div 3 = \underline{\quad}$
Square	4	$360^\circ \div 4 = \underline{\quad}$	$2 \times 180^\circ = \underline{\quad}$	$\underline{\quad} \div 4 = \underline{\quad}$
Pentagon	5			
Hexagon				
Heptagon				
Octagon				
Nonagon				
Decagon				
<i>n</i> -sided polygon	<i>n</i>	$360^\circ \div \underline{\quad}$	$\underline{\quad} \times 180^\circ$	$\underline{\quad} \div \underline{\quad}$

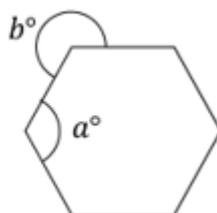
8. What is each interior angle of a regular polygon with 14 sides?

9. Calculate the sum of the interior angles of a polygon with 22 sides.

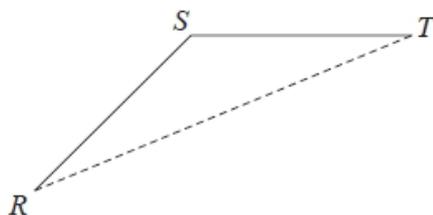
9. Each interior angle of a regular polygon is 168° . How many sides does the polygon have?

10. How many sides do these regular polygons have if their exterior angles are...?
a) 30° b) 18°

- 11 The diagram shows a regular hexagon.
What are the sizes of angles a and b ?



- 12



RS and ST are 2 sides of a regular 12-sided polygon.
 RT is a diagonal of the polygon.

Work out the size of angle STR .
You must show your working.



Percentages



Percentage of amounts

Non-Calculator Method:

- To find 10% - divide by 10
- To find 1% - divide by 100
- To find 25% - divide by 4
- To find 50% - divide by 2
- To find 75% - divide by 4 (to find 25%) then multiply by 3

These useful percentages can be used to build up any percentage of amount.

Example – Find 42% of £80

$$\begin{aligned}
 10\% &= 80 \div 10 = 8 \\
 40\% &= 4 \times 10\% \\
 &= 4 \times 8 \\
 &= 32 \\
 1\% &= 80 \div 100 = 0.8 \\
 2\% &= 2 \times 1\% \\
 &= 2 \times 0.8 \\
 &= 1.60
 \end{aligned}$$

$$\begin{aligned}
 42\% &= 40\% + 2\% \\
 &= 32 + 1.60 \\
 &= £33.60
 \end{aligned}$$

Have a calculator?

Much easier!

$$80 \times 0.42 = £33.60$$

Change the percentage into its decimal equivalent to easily find the percentage of an amount.

Percentage Multipliers

To increase by a percentage, add the increase percentage to 100%, convert to the decimal equivalent and multiply.

For example:

$$\begin{aligned}
 \text{Increase } £50 \text{ by } 12\% & \\
 50 \times 112\% & \\
 = 50 \times 1.12 & \\
 = £56 & \text{ (don't forget units)}
 \end{aligned}$$

In this example 1.12 is the multiplier

To decrease by a percentage subtract the decrease percentage from 100%, convert to the decimal equivalent and multiply.

For example:

$$\begin{aligned}
 \text{Decrease } 85 \text{ kg by } 4\% & \\
 85 \times 96\% & \\
 = 85 \times 0.96 & \\
 = 81.6 \text{ kg} & \text{ (don't forget units)}
 \end{aligned}$$

In this example 0.96 is the multiplier

Percentage change

$$\% \text{ change} = \frac{\text{difference}}{\text{original amount}} \times 100$$

Example: A house increased in value from £138,000 to £156,000 over the last five years. What percentage increase is this?

$$\begin{aligned}
 \% \text{ increase} &= \frac{156000 - 138000}{138000} \times 100 \\
 &= 13.04347826 \\
 &= 13\% \text{ (2sf)}
 \end{aligned}$$

This formula also works for decreases.

Example: Tracey kept chickens – unfortunately the chickens were traumatised by a fox and their mean average egg production went down from 32 eggs a week to 14 eggs a week. What % reduction in their egg production is this?

$$\begin{aligned}
 \% \text{ reduction} &= \frac{32 - 14}{32} \times 100 \\
 &= 56.25\%
 \end{aligned}$$

Reverse percentage

Think of this as finding the original amount after a % increase or % decrease

Example: A dress was reduced by 80% in a sale and its new price was £34. What was the price before the sale?

Calculator method

$$34 \div 0.2 = £170$$

Divide by the percentage multiplier that would have been used to decrease the original amount.

Non-Calculator Method

$$\begin{aligned}
 \text{After the reduction } £34 &= 20\% \\
 \text{Therefore } 1\% &= 34 \div 20 \\
 &= 1.7
 \end{aligned}$$

The original price would be equal to 100%
 $100\% = 100 \times 1.7$
 $= £170$

Year 9 Higher – Percentages

1. Non- Calculator – show all workings

a) Find 15% of 80

b) Find 40% of 80

c) Find 65% of 80

d) Find 103% of 80

2. Calculator - but you must write down what you input into your calculator

a) Calculate 20% of £340

b) Calculate 33 % of £340

c) Calculate 12.5% of £340

d) Calculate 0.5% of £340

3.

Lydia is buying a ring.
The ring costs £60
She pays a deposit of 40%.
Work out how much she pays as the deposit.

4.

A set of tyres normally costs £500
In a sale there is a 30% discount.
Work out the sale price of the set of tyres.

5.

There are men and women at a meeting.
There are 28 women.
30% of the people at the meeting are men.
Work out the total number of people at the meeting.

6.

Franco buys a house for £146 500
He sells the house for £158 220
Calculate the percentage profit Franco makes.

7

Last year Jo paid £245 for her car insurance.
This year she has to pay £883 for her car insurance.
Work out the percentage increase in the cost of her car insurance.

- 8 The price of all rail tickets increased by 5 %.
The price of a rail ticket from London to Ipswich increased by £2.30
Work out the price of the ticket before the increase.
-

9.
In a sale, the price of a TV is reduced by 25%
A week later, the sale price of the TV is reduced by 15%
The price of the TV is now £293.25
What was the price of the TV before the sale?
-

10.
In a sale, normal prices are reduced by 20%.
The normal price of a coat is reduced by £15
Work out the normal price of the coat.
-

11.
In a sale, the normal price of a book is reduced by 30%.
The sale price of the book is £2.80
Work out the normal price of the book.



Repeated Proportional Change



Percentage Multipliers

To increase by a percentage add the increase percentage to 100%, convert to the decimal equivalent and multiply.

For example:

$$\begin{aligned} \text{Increase } \pounds 50 \text{ by } 12\% \\ &= 50 \times 112\% \\ &= 50 \times 1.12 \\ &= \pounds 56 \quad (\text{don't forget units}) \end{aligned}$$

In this example 1.12 is the multiplier

To decrease by a percentage subtract the decrease percentage from 100%, convert to the decimal equivalent and multiply.

For example:

$$\begin{aligned} \text{Decrease } 85 \text{ kg by } 4\% \\ &= 85 \times 96\% \\ &= 85 \times 0.96 \\ &= 81.6 \text{ kg} \quad (\text{don't forget units}) \end{aligned}$$

In this example 0.96 is the multiplier

If a value is being increased or decreased by the same percentage over regular intervals we can use the following formula.

$$\text{Final amount} = \text{Principal amount} \times (\% \text{ multiplier})^n$$

Where n is the number of years/months/days etc

This formula works for increases and decreases.

Worked Examples

Tom invests $\pounds 3000$ for 5 years with a fixed compound interest rate of 3.5%. How much does Tom have after 5 years?

$$3000 \times 1.035^5 = \pounds 3563.06$$

Principal amount Multiplier Number of regular intervals

The population in a village is decreasing at a rate of 1% every 6 months. If the population is presently 2200, what will it be in 4 years?

$$2200 \times 0.99^8 = 2030.03 \dots$$

Principal amount Multiplier Number of 6 month intervals in 4 years

It may not always be the same percentage – in this case you cannot use the above formula but you can still work it out using just one calculation.

For example:

An investment of $\pounds 4350$ earns 5% interest in the first year, 4% in the second year and 3% in the following 2 years. What is the investment worth after these 4 years?

$$4350 \times 1.05 \times 1.04 \times 1.03^2 = \pounds 5039.49$$

Year 9 Higher – Repeated Proportional Change

1. If £500 is invested for 3 years at a rate of compound interest of 4% per annum, how much will be in the account after 3 years?

2. Dave invests £3000 at a rate of interest of 6% a year. How much is in his account after 5 years?

3. Glenn invests £7000 at a rate of interest of 2% for 4 years.

a. What is the total in his account after the 4 years?

b. How much interest would he have gained?

c. If he had invested the same amount of money in a different account at an interest rate of 4% for only three years would he have made more or less money? Show your working clearly.

4. Annie invests £1500 at a rate of compound interest of 2.5% for 6 years. How much is in her account after the six years?

5. 2. Harry invests £1000 at a rate of interest of 5% a year. After how many years will he have doubled his investment?

6. Henry invests £4500 at a compound interest rate of 5% per annum.
At the end of n complete years the investment has grown to £5469.78.
Find the value of n .

Challenge

-
- 7 Ella wants to invest £6000 in a savings account for 2 years.
She finds information about savings accounts at two different banks.

Northway Bank
Compound interest
of
3.8% per annum

Portland Bank
Compound interest
of
5% per annum in year 1
3.2% per annum in year 2

Ella wants to choose the bank that pays the greater total amount of interest for the 2 years.
Which bank should she choose?
You must show all your working.

8 John buys a house for £219000. The house depreciates in value at 6% each year. What is the value of the house after 7 years?

9. The value of a car depreciates by 15% each year. At the end of 2007, the value of the car was £8490. Work out the value of the car at the end of 2010.

10. 1. Bill buys a new lawnmower.
The value of the lawnmower depreciates by 20% each year.
Bill says "after 5 years the lawnmower will have no value"
a) Bill is wrong. Explain why.

Bill wants to work out the value of the lawnmower after 2 years.

b) By what single number should Bill multiply the value of the lawnmower when new?

11. A ball fell 2 metres onto horizontal ground.
The ball hit the ground and bounced up and down 3 times.
The first time the ball bounced, it rose to 75% of the height it fell from.
The second time the ball bounced, it rose to 75% of the height it reached after the first bounce.
The third time the ball bounced, it rose to 75% of the height it reached after the second bounce.
Work out the height the ball reached after the third bounce.
Give your answer correct to 2 decimal places.



Algebra – Expanding Brackets



To expand a bracket, multiply each term in the bracket by the expression outside the bracket.



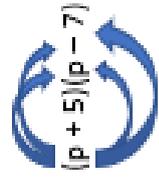
expand $3(y + 4)$
 $= 3y + 12$

Or you can use a table

	y	+4
3	3y	+12

So $3(y + 4) = 3y + 12$

To expand a double bracket, multiply each term in the first bracket by each term in the second bracket.



Expand $(p + 5)(p - 7)$
 $= p^2 - 7p + 5p - 35$
 $= p^2 + 2p - 35$

Or you can use a table making sure you include the positives and negatives.

	p	-7
p	p ²	-7p
+5	+5p	-35

$= p^2 - 7p + 5p - 35$
 $= p^2 + 2p - 35$

To expand and simplify two brackets – multiply out the brackets and then simplify by collecting like terms being extremely careful with any negative signs.

Expand and simplify $3(2d + 5) - 5(3d - 4)$

Multiply out $= 6d + 15 - 15d + 20$

Simplify by collecting like terms $= -9d + 35$

To expand a triple bracket: first multiply two of the brackets then multiply each term of the result by each term of the remaining bracket.

Expand $(p + 5)(p - 7)(p - 4)$ First expand $(p + 5)(p - 7)$
 $= p^2 + 2p - 35$

Then multiply the result by the final bracket



So $(p + 5)(p - 7)(p - 4) = (p^2 + 2p - 35)(p - 4)$
 $= p^3 - 4p^2 + 2p^2 - 8p - 35p + 140$
 $= p^3 - 2p^2 - 43p + 140$

Always write your answer in its simplest form by collecting like terms.

Things to look out for....

$(y + 5)^2 = (y + 5)(y + 5)$

$(h - 3)^3 = (h - 3)(h - 3)(h - 3)$

So

$(2y - 3)(y + 5)^2 = (2y - 3)(y + 5)(y + 5)$

Year 9 Higher – Expanding Brackets

1. Expand the single brackets

$$5(y + 3) =$$

$$b) \quad 3(w - 6) =$$

$$c) \quad a(b + 7) =$$

$$d) \quad -5(2q - 3) =$$

$$e) \quad 4(5t + 6) =$$

$$f) \quad 2d(5e + 2f) =$$

$$g) \quad 2y(3y - 2) =$$

$$h) \quad 3g^2(g^2 + 5g) =$$

$$i) \quad 8rt(3s - 5st + 7t^2) =$$

$$j) \quad 5abc(abc^2 + 9ab^4 - 3abc + 23b^5c^{-3}) =$$

2. Expand and simplify

$$a) \quad 5(y - 7) + 2y + 3 =$$

$$b) \quad 7 - 6(2g + 7) =$$

Expand each bracket first and then simplify these expressions:

(a) $6(4x - 3) + 3(4x - 1)$

(b) $5(5z + 12) + 3(5z - 2)$

(c) $y(5y + 6) - y(y - 5)$

(d) $r(5r + p) + 2r(r + p)$

(e) $2s(2t + p) + 2t(s + p)$

(f) $4a(3b + p) - 2a(a - p)$

Expand and simplify

a) $(h + 5)(h + 8)$

b) $(g - 7)(g - 3)$

c) $(b - 4)(b + 11)$

d) $(2y + 3)(2y - 5)$

e) $(5j - 4)(2j + 11)$

f) $(a + b)(c + d)$

g) $(4p - 3)^2$

h) $5(2a + b)(a - 6b)$

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

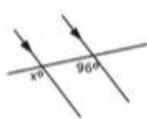
j) $(p + 2)(2p - 3)(p - 1)$

k) $(b + 2)^2(b - 1)$

l) $(2b - 5)^3$

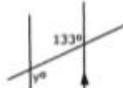
Year 9 Higher – Angles; parallel lines and polygons

1. Find the missing angle – give a reason for your answer.



$x = 96^\circ$
Corresponding angles are equal

2. Find the missing angle – give a reason for your answer.



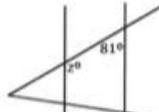
$y = 123^\circ$
alternate angles are equal

3. Find the missing angle – give a reason for your answer.



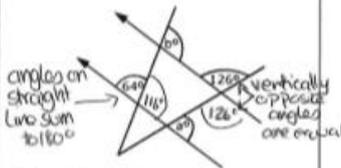
$x = 180 - 126 = 54^\circ$
allied angles sum to 180°

4. Find the missing angle – give a reason for your answer.



$z = 180 - 81 - 20 = 79^\circ$
allied angles sum to 180°

5. Find the missing angles – give reasons for your answer.



angles on straight line sum to 180°
 $a = 180 - 126 = 54^\circ$ (allied angles sum to 180°)
 $b = 116^\circ$ (corresponding angles are equal)

6. Find the missing angles – give reasons for your answer.



$n = 54^\circ$ (corresponding angles are equal)
 $m = 180 - 68 - 54 = 58^\circ$ (angles in a triangle sum to 180°)

7 Complete the table

Name of regular polygon	Number of Sides	Size of exterior angle	Sum of all interior angles	Size of interior angle
Equilateral triangle	3	$360^\circ \div 3 = 120^\circ$	$1 \times 180^\circ = 180^\circ$	$180 \div 3 = 60^\circ$
Square	4	$360^\circ \div 4 = 90^\circ$	$2 \times 180^\circ = 360^\circ$	$360 \div 4 = 90^\circ$
Pentagon	5	72°	540°	$540 \div 5 = 108^\circ$
Hexagon	6	60°	720°	$720 \div 6 = 120^\circ$
Heptagon	7	51.43°	900°	$900 \div 7 = 128.57^\circ$
Octagon	8	45°	1080°	$1080 \div 8 = 135^\circ$
Nonagon	9	40°	1260°	$1260 \div 9 = 140^\circ$
Decagon	10	36°	1440°	$1440 \div 10 = 144^\circ$
n-sided polygon	n	$360^\circ \div n$	$(n-2) \times 180^\circ$	$\frac{(n-2) \times 180}{n}$

8. What is each interior angle of a regular polygon with 14 sides?

$\frac{(14-2) \times 180^\circ}{14} = 157.29^\circ$

9. Calculate the sum of the interior angles of a polygon with 22 sides.

$(n-2) \times 180^\circ = (22-2) \times 180^\circ = 20 \times 180^\circ = 3600^\circ$

9. Each interior angle of a regular polygon is 168° . How many sides does the polygon have?

$180 - 168 = 12^\circ$ (exterior angle)
 $360 \div 12 = 30$
30 sides.

10. How many sides do these regular polygons have if their exterior angles are...?
a) 30° b) 18°

a) $360 \div 30 = 12$ sides
b) $360 \div 18 = 20$ sides

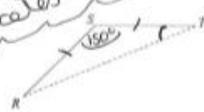
11. The diagram shows a regular hexagon. What are the sizes of angles a and b?



$\frac{(n-2) \times 180}{n} = \frac{(6-2) \times 180}{6} = 120^\circ$

$\therefore a = 120^\circ$
 $b = 360 - 120 = 240^\circ$ (angles around a point sum to 360°)

12. regular polygon, so side lengths are equal so RST is an isosceles triangle



RS and ST are 2 sides of a regular 12-sided polygon. RT is a diagonal of the polygon.

Work out the size of angle STR. You must show your working.

$\frac{(n-2) \times 180}{n} = \frac{12 \times 180}{12} = 150^\circ$ (angle RST)
angle STR = $\frac{180 - 150}{2} = 15^\circ$ (base angles in an isosceles triangle are equal)

Year 9 Higher – Percentages

1. Non-Calculator – show all workings

a) Find 15% of 80
 $10\% = 80 \div 10 = 8$
 $5\% = 8 \div 2 = 4$
 $15\% = 8 + 4 = 12$

b) Find 40% of 80
 $10\% = 8$
 $40\% = 4 \times 8 = 32$

c) Find 65% of 80
 $50\% = 40$
 $10\% = 8$
 $5\% = 4$
 $\therefore 65\% = 40 + 8 + 4 = 52$

d) Find 103% of 80
 $1\% = 0.8$
 $3\% = 2.4$
 $103\% = 80 + 2.4 = 82.4$

2. Calculator – but you must write down what you input into your calculator

a) Calculate 20% of £340
 $340 \times 0.2 = £68$

b) Calculate 33% of £340
 $340 \times 0.33 = £112.20$

c) Calculate 12.5% of £340
 $340 \times 0.125 = £42.50$

d) Calculate 0.5% of £340
 $340 \times 0.005 = £1.70$

3. Lydia is buying a ring.
The ring costs £60.
She pays a deposit of 40%.
Work out how much she pays as the deposit.

Calculator method
 $60 \times 0.4 = £24$

or $10\% = 60 \div 10 = 6$
 $40\% = 6 \times 4 = 24$
She pays £24 as a deposit

4. A set of tyres normally costs £500.
In a sale there is a 30% discount.
Work out the sale price of the set of tyres.

Calculator method
 $500 \times 0.7 = £350$

or $10\% = 50$
 $30\% = 50 \times 3 = 150$
 $500 - 150 = £350$

5. There are men and women at a meeting.
There are 28 women.
30% of the people at the meeting are men.
Work out the total number of people at the meeting.

If 30% are men
70% are women

$70\% = 28$
 $10\% = 4$
and $100\% = 4 \times 10 = 40$
There are 40 people at the meeting

6. Franco buys a house for £146,500.
He sells the house for £158,220.
Calculate the percentage profit Franco makes.

$\% \text{ profit} = \frac{158220 - 146500}{146500} \times 100 = 8\%$

7. Last year I paid £245 for her car insurance.
This year she has to pay £883 for her car insurance.
Work out the percentage increase in the cost of her car insurance.

$\% \text{ inc} = \frac{883 - 245}{245} \times 100 = 260.40816 \dots = 260\%$

8. The price of all rail tickets increased by 5%.
The price of a rail ticket from London to Ipswich increased by £2.30.
Work out the price of the ticket before the increase.

$5\% = 2.30$
 $100\% = 2.30 \times 20 = £46.00$

9. In a sale, the price of a TV is reduced by 25%.
A week later, the sale price of the TV is reduced by 15%.
The price of the TV is now £293.25.
What was the price of the TV before the sale?

Hard Question!
 $293.25 \div 0.85 \div 0.75 = £460.00$

$75\% = 293.25$
 $1\% = 3.45$
 $100\% = 345$
 $75\% = 345$
 $\therefore 25\% = 115$
 $100\% = 115 \times 4 = £460.00$

10. In a sale, normal prices are reduced by 20%.
The normal price of a coat is reduced by £15.
Work out the normal price of the coat.

$20\% = £15$
 $100\% = £75$
normal price = £75

11. In a sale, the normal price of a book is reduced by 30%.
The sale price of the book is £2.80.
Work out the normal price of the book.

Two methods.
 $2.8 \div 0.7 = £4$

$70\% = 2.80$
 $10\% = 0.40$
 $100\% = £4.00$

Year 9 Higher – Repeated percentage change

1. If £500 is invested for 3 years at a rate of compound interest of 4% per annum, how much will be in the account after 3 years?

$500 \times 1.04^3 = £562.43$

2. Dave invests £3000 at a rate of interest of 6% a year. How much is in his account after 5 years?

$3000 \times 1.06^5 = £4014.68$

3. Glenn invests £7000 at a rate of interest of 2% for 4 years.

a. What is the total in his account after the 4 years?
 $7000 \times 1.02^4 = £7577.03$

b. How much interest would he have gained?
 $7577.03 - 7000 = £577.03$

c. If he had invested the same amount of money in a different account at an interest rate of 4% for only three years would he have made more or less money? Show your working clearly.
 $7000 \times 1.04^3 = £7874.05$
 $£7874.05 > £7577.03$ so Glenn would have made more money.

4. Annie invests £1500 at a rate of compound interest of 2.5% for 6 years. How much is in her account after the six years?
 $1500 \times 1.025^6 = £1739.54$

5. 2. Harry invests £1000 at a rate of interest of 5% a year. After how many years will he have doubled his investment?

Trick & Improvement
 1000×1.05^n
 $1000 \times 1.05^8 = 1477.45$
 $1000 \times 1.05^{12} = 1795.86$
 $1000 \times 1.05^{15} = 2078.93$
 $1000 \times 1.05^{14} = 1979.93$
15 years

6. Henry invests £4500 at a compound interest rate of 5% per annum. At the end of n complete years the investment has grown to £5469.78. Find the value of n .

Challenge
 $4500 \times 1.05^n = 5469.78$
 $1.05^n = \frac{5469.78}{4500} = 1.2155066$
 $1.05^3 = 1.1576$
 $1.05^4 = 1.2155$
 $n = 4$

Trick & Improvement

7. Ella wants to invest £6000 in a savings account for 2 years. She finds information about savings accounts at two different banks.

Northway Bank Compound interest of 3.8% per annum	Portland Bank Compound interest of 3% per annum in year 1 3.2% per annum in year 2
------------------------------------------------------------	------------------------------------------------------------------------------------------------

Ella wants to choose the bank that pays the greater total amount of interest for the 2 years. Which bank should she choose? You must show all your working.

Northway | Portland

$6000 \times 1.038^2 = £6464.66$ | $6000 \times 1.05 \times 1.032 = £6501.60$

$6501.60 > 6464.66$

Ella should choose Portland Bank as she will receive £36.94 more interest.

- 8 John buys a house for £219000. The house depreciates in value at 6% each year. What is the value of the house after 7 years?

$$219000 \times 0.94^7 = \pounds 142016.59$$

9. The value of a car depreciates by 15% each year. At the end of 2007, the value of the car was £890. Work out the value of the car at the end of 2010.

$$8490 \times 0.85^3 = \pounds 5213.92$$

10. 1. Bill buys a new lawnmower. The value of the lawnmower depreciates by 20% each year. Bill says "after 5 years the lawnmower will have no value".
a) Bill is wrong. Explain why.

Because each year it will reduce by 20% but it's the reduced value being reduced each year not the original value and $0.8^5 \neq 0$

- Bill wants to work out the value of the lawnmower after 2 years.
b) By what single number should Bill multiply the value of the lawnmower when new?

$$0.8^2 = 0.64$$

11. A ball fell 2 metres onto horizontal ground. The ball hit the ground and bounced up and down 3 times. The first time the ball bounced, it rose to 75% of the height it fell from. The second time the ball bounced, it rose to 75% of the height it reached after the first bounce. The third time the ball bounced, it rose to 75% of the height it reached after the second bounce. Work out the height the ball reached after the third bounce. Give your answer correct to 2 decimal places.

$$\begin{aligned} 2 \times 0.75 \times 0.75 \times 0.75 \\ = 0.84375 \\ = 0.84 \text{ m} \end{aligned}$$

Expand each bracket first and then simplify these expressions:

(a) $6(4x-3) + 3(4x-1)$
 $= 24x - 18 + 12x - 3$
 $= 36x - 21$

(b) $5(5z+12) + 3(5z-2)$
 $= 25z + 60 + 15z - 6$
 $= 40z + 54$

(c) $y(5y+6) - y(y-5)$
 $= 5y^2 + 6y - y^2 + 5y$
 $= 4y^2 + 11y$

(d) $r(5r+p) + 2r(r+p)$
 $= 5r^2 + rp + 2r^2 + 2rp$
 $= 7r^2 + 3rp$

(e) $2s(2t+p) + 2t(s+p)$
 $= 4st + 2sp + 2st + 2pt$
 $= 6st + 2sp + 2pt$

(f) $4a(3b+p) - 2a(a-p)$
 $= 12ab + 4ap - 2a^2 + 2ap$
 $= 12ab + 6ap - 2a^2$

Answers Year 9 Higher - Expanding Brackets

1. Expand the single brackets

a) $5(y+3) = 5y+15$

b) $3(w-6) = 3w-18$

c) $a(b+7) = ab+7a$

d) $-5(2q-3) = -10q+15$

e) $4(5t+6) = 20t+24$

f) $2d(5e+2f) = 10de+4df$

g) $2y(3y-2) = 6y^2-4y$

h) $3g^2(g^2+5g) = 3g^4+15g^3$

i) $8rt(3s-5st+7t^2) =$
 $= 24rst - 40rst^2 + 56rt^3$

j) $5abc(abc^2+9ab^4-3abc+23b^3c^2) =$
 $= 5a^2b^2c^3 + 45a^2b^5c - 15a^2b^2c^2 + 115ab^3c^2$

1. Expand and simplify

a) $5(y-7) + 2y + 3 =$
 $= 5y - 35 + 2y + 3$
 $= 7y - 32$

b) $7 - 6(2g+7) = 7 - 12g - 42$
 $= -12g - 35$

Expand and simplify

a) $(h+5)(h+8) =$
 $= h^2 + 8h + 5h + 40$
 $= h^2 + 13h + 40$

b) $(g-7)(g-3) = g^2 - 3g - 7g + 21$
 $= g^2 - 10g + 21$

c) $(b-4)(b+11) =$
 $= b^2 + 11b - 4b - 44$
 $= b^2 + 7b - 44$

d) $(2y+3)(2y-5) = 4y^2 - 10y + 6y - 15$
 $= 4y^2 - 4y - 15$

e) $(5j-4)(2j+11) =$
 $= 10j^2 + 55j - 8j - 44$
 $= 10j^2 + 47j - 44$

f) $(a+b)(c+d) = ac + ad + bc + bd$

g) $(4p-3)^2 = (4p-3)(4p-3) =$
 $= 16p^2 - 12p - 12p + 9$
 $= 16p^2 - 24p + 9$

h) $5(2a+b)(a-6b) =$
 $= 5(2a^2 - 12ab + ab - 6b^2)$
 $= 5(2a^2 - 11ab - 6b^2)$
 $= 10a^2 - 55ab - 30b^2$

i) $(y+1)(y+3)(y-2) =$
 $(y+1)(y+3) = y^2 + 3y + y + 3$
 $= y^2 + 4y + 3$

j) $(p+2)(2p-3)(p-1) =$
 $(p+2)(2p-3) = 2p^2 - 3p + 4p - 6$
 $= 2p^2 + p - 6$

$(y^2 + 4y + 3)(y-2) =$
 $(y^2 + 4y + 3)(y-2) = y^3 + 4y^2 + 3y - 2y^2 - 8y - 6$
 $= y^3 + 2y^2 - 5y - 6$

$(2p^2 + p - 6)(p-1) =$
 $(2p^2 + p - 6)(p-1) = 2p^3 + p^2 - 6p - 2p^2 - p + 6$
 $= 2p^3 - p^2 - 7p + 6$

k) $(b+2)^2(b-1) = (b+2)(b+2)(b-1) =$
 $(b+2)(b+2) = b^2 + 2b + 2b + 4$
 $= b^2 + 4b + 4$

l) $(2b-5)^2 = (2b-5)(2b-5) =$
 $(2b-5)(2b-5) = 4b^2 - 10b - 10b + 25$
 $= 4b^2 - 20b + 25$

$(b^2 + 4b + 4)(b-1) =$
 $(b^2 + 4b + 4)(b-1) = b^3 + 4b^2 + 4b - b^2 - 4b - 4$
 $= b^3 + 3b^2 - 4$

$(2b-5)^3 = (4b^2 - 20b + 25)(2b-5) =$
 $(4b^2 - 20b + 25)(2b-5) = 8b^3 - 40b^2 + 50b - 20b^2 + 100b - 125$
 $= 8b^3 - 60b^2 + 150b - 125$

