Whole Numbers and Place Value

Series G – Whole Numbers and Place Value

Contents

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Read and understand numbers – place value to millions

The place of a digit in a number tells us its value.

6,216,085

6 is worth	6,000,000 or 6 millions
2 is worth	200,000 or 2 hundred thousands
1 is worth	10,000 or 1 ten thousand
6 is worth	6,000 or 6 thousands
0 is worth	0 or 0 hundreds
8 is worth	80 or 8 tens
5 is worth	5 or 5 ones

1 Fill in the place value chart for each number. The first one has been done for you.

	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
816,958		8	1	6	9	5	8
1,254,958							
91,806							
3,048,787							
958,656							
1,362,055							

2 Circle the larger number:

a 7,240,547 / 7,241,253

b 8,519,476 / 8,591,476

c 4,353,537 / 4,453,540

d 3,525,461 / 3,525,614

e 2,512,444 / 2,512,333

f 2,432,498 / 2,433,498

3 Write the next 3 numbers in each sequence:

a + 10,000   33,591

b + 1,000,000   2,459,012

c − 1,000   708,518

d − 100   4,000,524

Read and understand numbers – place value to millions

4 **Write a...**

a 7-digit number with a 7 in the thousands column and a 0 in the hundred thousands column.

b 6-digit number where the digit in the 100s column is double the digit in the hundred thousands column.

c 8-digit number with a square number in the millions column and a multiple of 4 in the units column.

d 7-digit number between five million two hundred and four thousand five hundred and twenty-five, and five million two hundred and five thousand five hundred and twenty-five.

....

5 **True or false?**

a 3,529,743 > three million five hundred thirty nine thousand seven hundred and forty three _____

b twenty six million eight hundred and forty thousand six hundred and thirty is double thirteen million four hundred and twenty thousand three hundred and fifteen _____

c sixty million three hundred and thirty thousand four hundred and one < 60,303,401 _____

....

6 **Complete the cross number puzzle:**

1		2			3	
	■		■	■		■
4		5				
	■			■		■
6						
	■			■		■

Across
1. one million thirty seven thousand eight hundred and fourteen
4. three million and forty nine thousand five hundred and six
6. one million

Down
1. one hundred and thirty three thousand eight hundred and fourteen
2. three hundred and eighty four thousand
3. one hundred thousand
5. nine thousand six hundred and two

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Read and understand numbers – expanded notation

When we write numbers using expanded notation, we identify and name the value of each digit.

3,154,231 = 3,000,000 + 100,000 + 50,000 + 4,000 + 200 + 30 + 1

1 **Convert the numbers into expanded notation. The first one has been done for you.**

a 4,246,936   *4,000,000 + 200,000 + 40,000 + 6,000 + 900 + 30 + 6*

b 88,421

c 2,856,913

d 714,533

e 7,240,547

f 4,215,632

g 770,421

h 467,809

2 **Write the number from the expanded notation. Remember to group the digits in 3s.**

a 500,000 + 20,000 + 3,000 + 700 + 40 + 1   _____

b 80,000 + 5,000 + 200 + 70 + 3   _____

c 400,000 + 5,000 + 200 + 50 + 2   _____

d 900,000 + 40,000 + 1,000 + 80 + 5   _____

e 20,000 + 7,000 + 300 + 8   _____

f 300,000 + 2,000 + 500 + 80 + 4   _____

g 800,000 + 50,000 + 6,000 + 200 + 30 + 8   _____

Read and understand numbers – order large numbers

When ordering numbers it is important to look closely at the place of the digits.

1   **Put the following numbers in order from smallest to largest:**

Number		
1,548,654		smallest
550,654		
1,547,521		
1,485,554		
1,547,656		
1,256,441		
995,841		largest

2   **Read the following instructions and complete the table:**

You are in charge of compiling the ratings for the top 10 television programs for the week. You have ordered them according to your personal preference but your editor is not amused.

She wants you to reorder them from most popular to least popular according to the number of viewers. This now seems like a good idea as you like your job and want to keep it.

Use the final column to record the correct order of popularity.

Your order	Program	Viewers	Revised order
1	Guess that Tune	840,000	
2	Romsey's Kitchen Nightmares	1,330,000	
3	Friends and Neighbours	1,432,000	
4	Big Sister	1,560,000	
5	Gladiator Fighters	1,290,000	
6	Sea Patrol 7	1,390,000	
7	Crime Scene Clues	1,388,000	
8	Crazy Housewives	1,300,000	
9	Tomorrow Tonight	740,000	
10	Better Homes and Backyards	1,360,000	

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3 Play this game with 3 friends. The aim is to make the biggest number you can. You'll each need to make a copy of this page and cut out your set of digit cards below. Put each player's cards together and shuffle. You only need one copy of the 5 points card for the whole group.

0	**1**	**2**	**3**	**4**
5	**6**	**7**	**8**	**9**
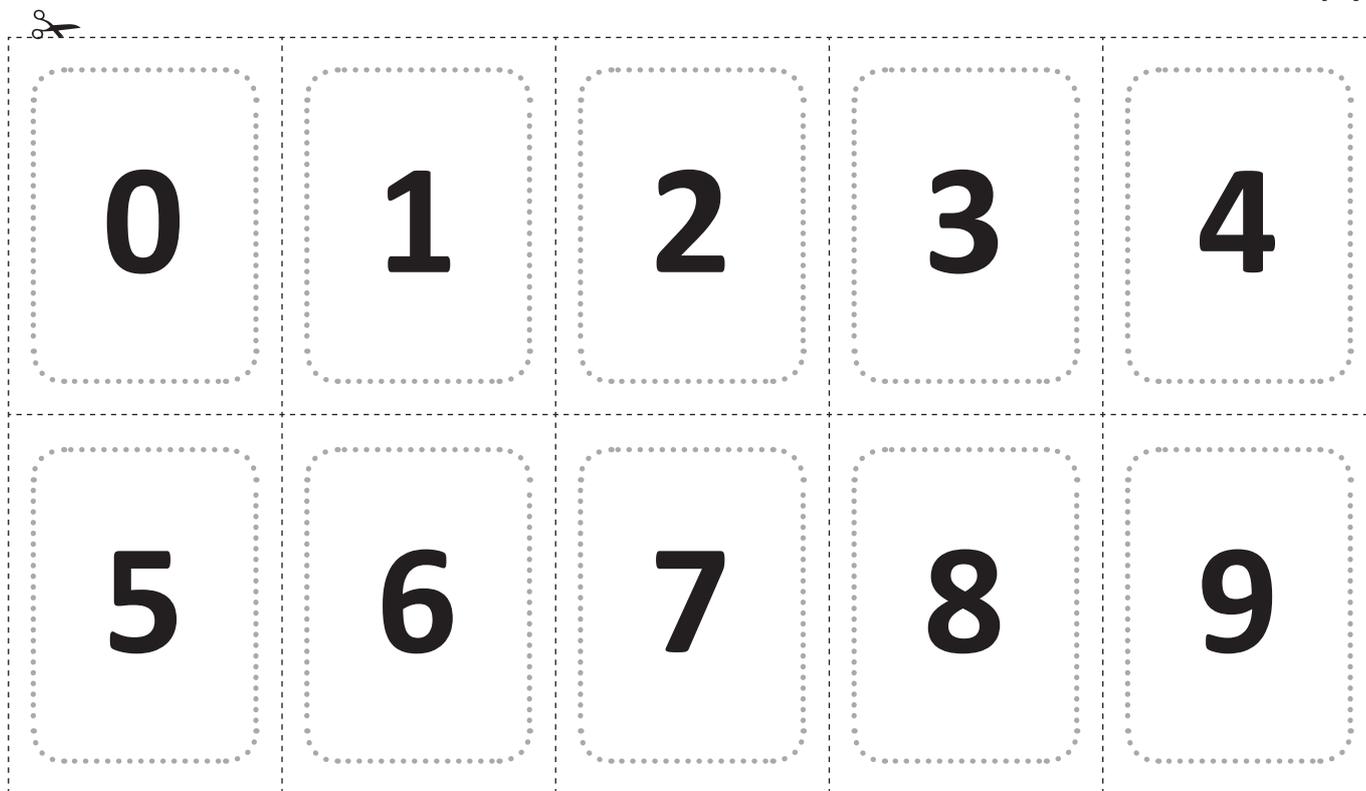
5 points

Instructions

1 Make sure you have shuffled the cards well before you deal out 7 cards to each player.

2 Turn the remaining cards face down in 1 pile.

3 Play 'scissors, paper, stone' to see who will go first. When it is their turn, players may swap one of their cards for the top card. It's a lucky dip though; the card may help or hinder!

4 Player 1 makes the biggest number they can using all their cards. They take the 5 point card as their number is the only one out there.

5 Player 2 then tries to make a larger number. If they can do so, then the 5 point card goes to them.

6 Player 3 and 4 follow the same steps.

7 The player with the largest number at the end of the game gets the 5 points. Keep score after each round.

8 Play again. Or try a different variation such as the smallest number, the largest even number or the smallest odd number.

The Millionaires' Club   solve

Getting ready

Congratulations! You and a friend have just inherited a lot of money and can join the Millionaires' Club. Your task is to order the members in the club, and then work out why there seem to be some cliques within the group.

What to do

1 Write your names and your respective wealth on the Club Membership Board. The **rule** is you must have less than 1 billion or you would be in the billionaires' club.

2 Reorder the board so the richest member of the club is at the top and the poorest (relatively speaking) is at the bottom. Don't forget to include yourself and your friend.

Group	Name	Wealth	Richest to poorest
A	John McSnooty	£1,560,016	
A	Maxy Million	£3,457,342	
A	Count More	£32,760,212	
B	Ms Heiress (and dog)	£25,820,433	
B	Lady Pennypincher	£10,720,899	
B	Money Hungry	£28,073,061	
C	Mrs Bigpurse	£2,100,565	
C	Mr Rich	£25,641,265	
C	Lord Loot	£12,740,090	

What to do next

1 Within the club there are a few cliques or **divisions**. Members of the same cliques have the same letter either A, B or C. You think that is **odd**. Can you work out why groups have been formed? Write the groups out again and look carefully at the numbers. Each group may **even** have more than one condition of entry. How many can you find?

2 Stuck? There are a couple of the rules hidden in this page. Look carefully at the text again. Some words may be written a little differently.

3 Which group(s) can you and your friend join according to the rules you find?

G **1**

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Whole Numbers and Place Value

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Zero the Hero   apply

Getting ready

In this activity, you are going to make different numbers by performing operations (not the medical kind) to remove zeros from a number. You will work with a partner. You'll need a calculator to share.
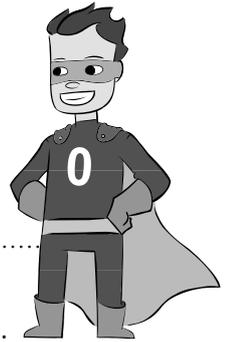
What to do

1 Enter a 6 digit number into a calculator. Make sure it contains 1 zero.

2 Pass the calculator to your partner. Their job is to remove the zero from the calculator using one addition or subtraction problem.

3 If they can read the number correctly and explain how they did it in 1 step they score 10 points.

4 Swap roles. The first person to score 50 points wins the game.

What to do next

Can you invent a similar game using a calculator? Does it need to be harder or easier for you to enjoy playing it? How could you change it? What will you ask your partner to do with the numbers? Try it out and refine it until it works well.

Write down your instructions so that another team can play your game. Swap your instructions with another team and play each other's game.

> Enter the number 46 783 into your calculator.
> I want to see a zero in the hundreds place.
> Can't do it? Drop down and give me 20 push-ups.

DISCOVER

> Having problems reading the numbers? You could put the numbers under headings to help you identify the value of the zero.

HT	TT	Th	H	T	O

CHECK

Types of numbers – negative numbers

Negative numbers are numbers with a value less than zero.

Negative numbers always have a minus sign before them.
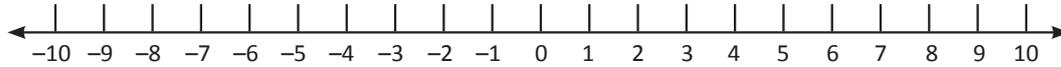
Negative numbers are used when we measure temperature and in transactions with money. When we are in debt, we have a negative balance. This means we owe money.

1 **What is the temperature showing on each thermometer in °C (degrees Celsius)?**

a   b   c   d   e   f   g
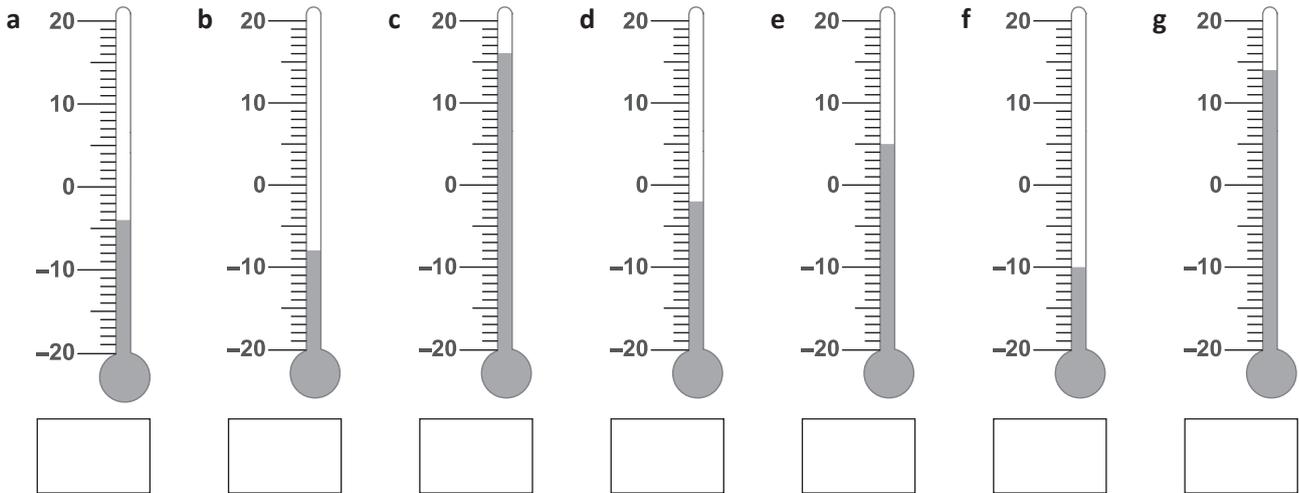
h On Wednesday morning the thermometer reads –4°C. One hour later it is 3°C colder.

The new temperature is
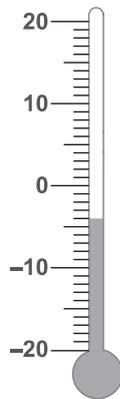
i On Thursday morning the thermometer reads –9°C. One hour later it is 4°C warmer.

The new temperature is
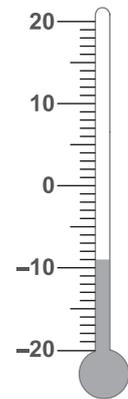
2 **Sarah had £10 in her bank account. What would the balance be if she:**

a Withdrew £15? _____

b Withdrew £9? _____

c Deposited £5? _____

d Deposited £2? _____

e Withdrew £20? _____

f Withdrew £12? _____

g Deposited £7? _____

h Withdrew £25? _____

Whole Numbers and Place Value

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Types of numbers – negative numbers

3 Mark the number line with the amount either added or subtracted. The first one has been done for you.

a $2 - 7 = \boxed{-5}$

b $1 - 5 = \boxed{}$

c $-4 + 7 = \boxed{}$

d $-6 + 3 = \boxed{}$

e $-1 - 7 = \boxed{}$
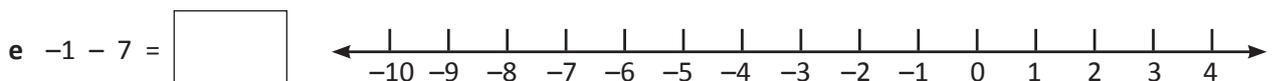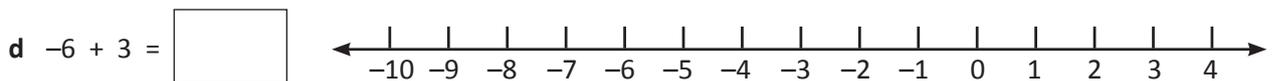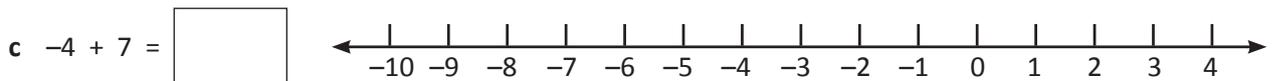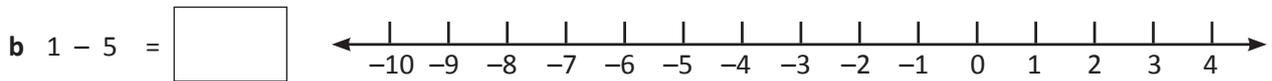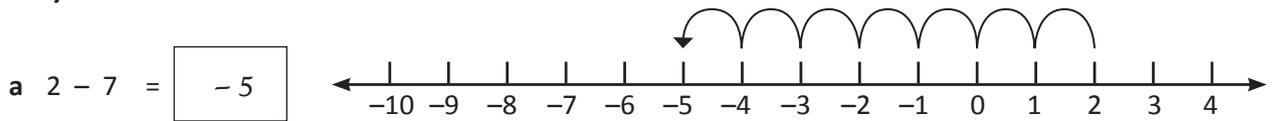
4 Use the number line to complete the number sentence:

a $\boxed{} - \boxed{} = \boxed{-2}$

b $\boxed{} + \boxed{} = \boxed{-5}$

c $\boxed{} - \boxed{} = \boxed{-7}$

d $\boxed{} + \boxed{} = \boxed{1}$
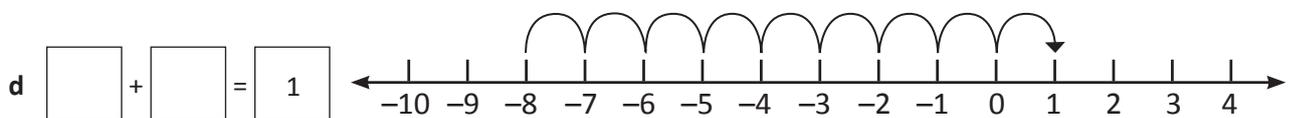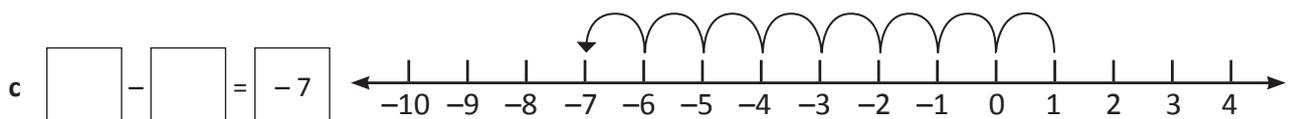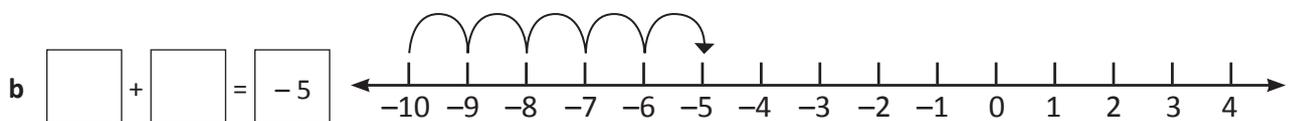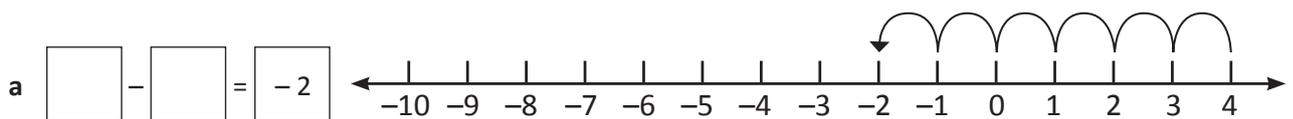
Types of numbers – mixed practice

1 **Work out what the secret numbers are. Assume all numbers are positive, unless stated otherwise.**

a I am the only even prime number. I am _____.

b I am one of the two numbers that are neither prime nor composite. I am not zero.

I am _____.

c I am a 2-digit number. I am less than 40. I am a prime number and my second digit is smaller than

my first number. I am _____.

d I am the negative number closest to positive numbers. I am _____.

e I am the 5-digit negative number furthest from zero. I am _____.

f I am the largest 5-digit number where no number is repeated. I am _____.

g I am the largest 4-digit number that uses the 4 smallest prime numbers. I am _____.

h I am a prime number. My digits add to total the smallest prime number. I am _____.

2 **In these next questions, there is more than 1 possible answer.**

a Look at the number 1,000,855.

Write 5 numbers that are larger than this with the same number of digits.

_____

Write 5 numbers that are smaller.

_____

b Rounded to the nearest 100 km, my train trip was 3,000 km long. How long could it have been?
How many answers to this question can you find?

Whole Numbers and Place Value

Types of numbers – Roman numerals

The numerals we use are part of the Hindu–Arabic numeral system. It is believed to have been invented in India and transmitted by the Moors (Arabs). Europeans adopted the system in the 12th century.

The Romans had their own system.

Study this Hindu–Arabic to Roman numerals conversion table.

Hindu–Arabic	Roman		Hindu–Arabic	Roman
0			20	XX
1	I		30	XXX
2	II		40	XL
3	III		50	L
4	IV		60	LX
5	V		70	LXX
6	VI		80	LXXX
7	VII		90	XC
8	VIII		100	C
9	IX		500	D
10	X		1,000	M

In the Roman system:

- You can have four numerals in the same row, such as IIII, but it is more usual to write it as IV.
- If you put a smaller number in front of a larger number, the smaller number is subtracted from the larger one (IV = 5 − 1 = 4 or XL = 50 − 10 = 40).
- There is no zero.

When we are expressing large numbers in Roman numerals, it is useful to work on one place value at a time.

$$MCCLXXVII = M + CC + LXX + VII$$
$$= 1{,}000 + 200 + 70 + 7$$
$$= 1{,}277$$

1   **Express the following numbers in Roman numerals:**

	Thousands	Hundreds	Tens	Ones
358				
612				
475				
939				
1,563				

Types of numbers – Roman numerals

2 **Express the following numbers in Roman numerals:**

a 18

b 47

c 34

d 92

e 115

f 776

g 469

h 900

i 138

j 82

....

3 **Convert the following Roman numerals into Hindu–Arabic numerals:**

a XXVII

b XIX

c LXII

d XLIV

e DXLVII

f CCLXXXV

g MCCCXXV

h XMLXXIX

....

4 These days, we only use Roman numerals when the credits roll in the movies – and sometimes on our watches!
These are 3 of the top grossing films of all time. When were they made?

a *Star Wars Epsiode IV* was made in MCMLXXVII

b *The Dark Knight* was made in MMVIII

c *Titanic* was made in MCMXCVII

We need a new system   create
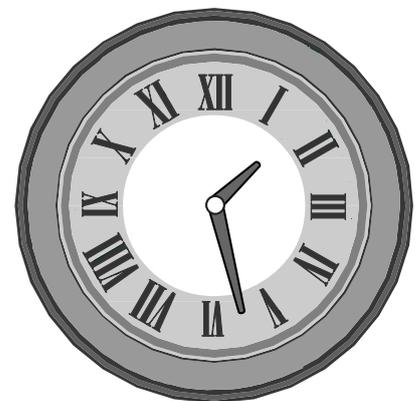
Getting ready

In this activity you are going to use what you know about our Hindu–Arabic number system and Roman numerals to invent your own number system.
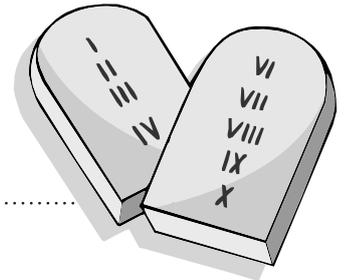
What to do

Look at the chart below. It shows numbers written in our Hindu–Arabic system and in Roman numerals. Design your own system. There is a column for you to record it.

What will you use in your system? Will you use symbols? Letters? Shapes? Will you use different symbols for values such as 1, 2, 3 or will you repeat them as in I, II, III? Will you use a **0** type symbol to develop a place value system so you can easily write numbers as 5, 50, 500?

Hindu–Arabic	Roman		Hindu–Arabic	Roman	
0			20	XX	
1	I		30	XXX	
2	II		40	XL	
3	III		50	L	
4	IV		60	LX	
5	V		70	LXX	
6	VI		80	LXXX	
7	VII		90	XC	
8	VIII		100	C	
9	IX		500	D	
10	X		1,000	M	

What to do next

Now you have your system, write 5 simple addition or subtraction problems using your numbers for a friend to solve.

1 _____

2 _____

3 _____

4 _____

5 _____

Can they work with your number system? It is trickier than it looks to invent a number system, and you may need to tweak it till you get it working.

Goldbach's conjecture

Getting ready

In the year 1742, a Prussian mathematician called Christian Goldbach looked at many sums and made a conjecture. He said that every even number over 4 is the sum of 2 prime numbers. (Actually he said over 2 but that was when 1 was considered a prime number. That is now *soooo* 1742.)

What to do

You have been asked by the Mathematics Institute to test this out.

How high can you go?

What will you need to help you solve this problem? You may want to use the table of prime numbers on page 15.

You can work by yourself or as part of a small group.

Here are a few to start you off.

Look at 8. It can be made by adding the prime numbers 3 and 5.

8
5 3

16 can be made by adding 11 and 5, and by adding 3 and 13.

16
11 5
3 13
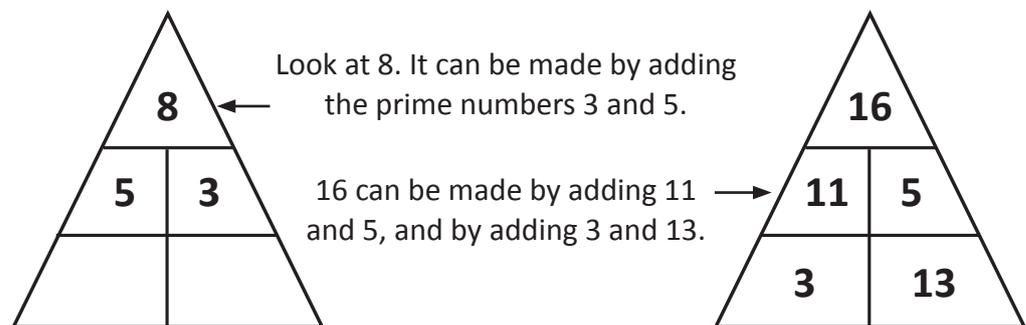
Use the triangles on page 15 to record your thinking. Or create your own.
You may need more!

What to do next

Which even number can be made the most ways? Discuss your answer with 2 friends. Do they agree?

Goldbach's theory has never been absolutely proven or disproven. The publishing group Faber and Faber offered a £1,000,000 prize to any one who could do so. No one was able to claim the prize at the end of the competition time. Who knows, you could be the one to claim the glory (if not the prize). You could rename the conjecture. What would you call it?

Whole Numbers and Place Value
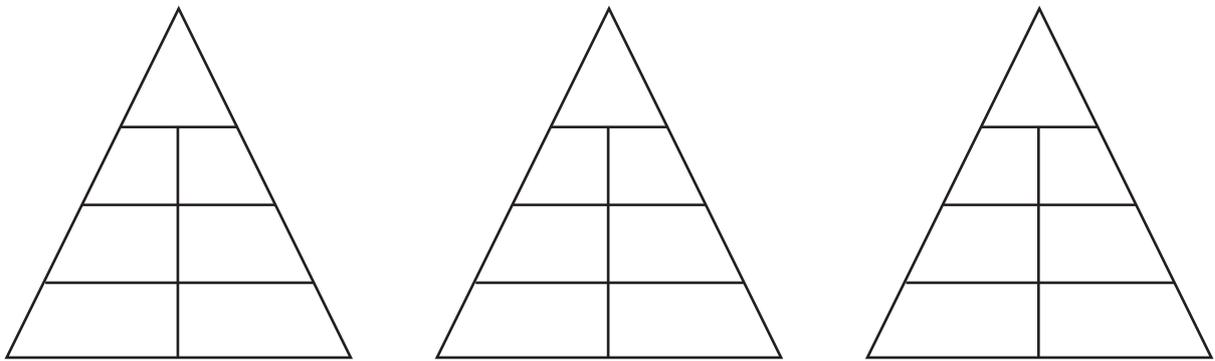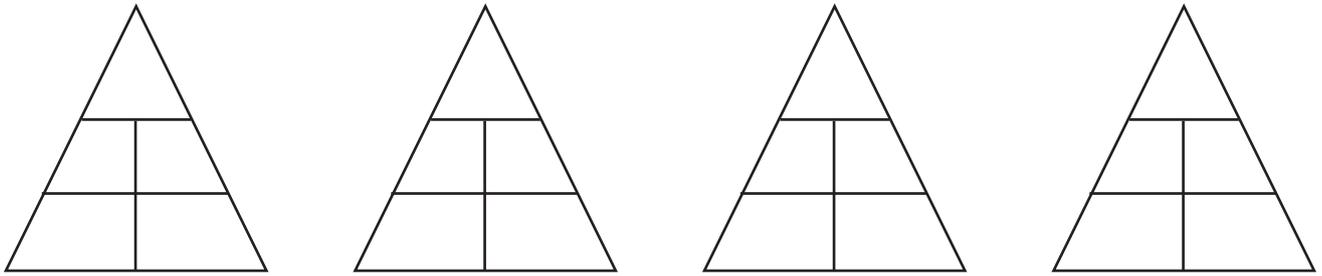
2	3	5	7	11	13
17	19	23	29	31	37
41	43	47	53	59	61
67	71	73	79	83	89
97	101	103	107	109	113
127	131	137	139	149	151
157	163	167	173	179	181
191	193	197	199	211	223
227	229	233	239	241	251
257	263	269	271	277	281
283	293	307	311	313	317
331	337	347	349	353	359
367	373	379	383	389	397
401	409	419	421	431	433
439	443	449	459	461	463
467	479	487	491	499	

Round and estimate – round to a power of ten

Rounding makes big numbers easier to work with. We round to numbers that we can deal with easily in our heads.

We most commonly round to the nearest 10 or power of 10.

210   350   770

```
0    100   200   300   400   500   600   700   800   900   1,000
```
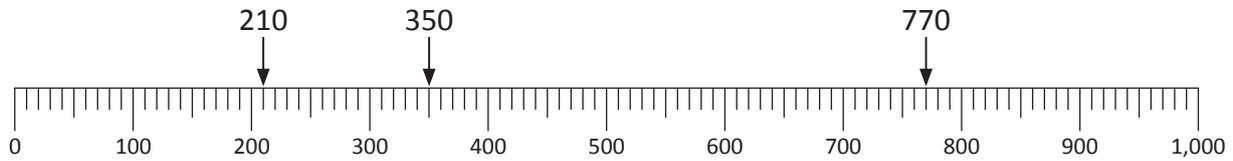
770 rounds to 800

210 rounds to 200

350 rounds to _400_

Round *up* when it is halfway between the 10s or more.

Round *down* when the number is less than halfway.

REMEMBER

1 **Round to the nearest thousand:**

a 12,388 _____   b 9,525 _____

c 39,610 _____   d 55,239 _____

e 8,392 _____   f 89,743 _____

....

2 **Round to the nearest ten thousand:**

a 14,987 _____   b 24,033 _____

c 36,095 _____   d 77,330 _____

e 245,302 _____   f 695,474 _____

....

3 **Round to the nearest hundred thousand:**

a 828,549 _____   b 653,200 _____

c 105,525 _____   d 223,669 _____

e 856,914 _____   f 449,987 _____

Whole Numbers and Place Value

Round and estimate – round to a power of ten

4 To find a secret fact about gorillas, round the numbers in the clues below and insert the matching letters above the answers.

___	___		___	___	___		___	___	___	___	___
2,000	50,000		400	8,000	20,000		400	8,000	50,000	400	200

___		___	___	___	___	___		___	___	___	___
8,000		200	70,000	500	8,000	20,000		400	7,000	900	10,000

H	249	rounded to the nearest hundred	**U**	69,623	rounded to the nearest thousand
N	19,432	rounded to the nearest ten thousand	**M**	462	rounded to the nearest hundred
T	49,832	rounded to the nearest thousand	**I**	2,490	rounded to the nearest thousand
L	850	rounded to the nearest hundred	**C**	361	rounded to the nearest hundred
D	10,320	rounded to the nearest thousand	**A**	7,711	rounded to the nearest thousand
O	6,625	rounded to the nearest thousand			

5 Answer true or false:

a	When rounding to the nearest hundred, 18,762 rounds to 19,000.	True / False
b	When rounding to the nearest thousand, 17,468 rounds to 17,000.	True / False
c	When rounding to the nearest ten, 5 rounds up.	True / False
d	We use rounding when we need to be absolutely precise.	True / False
e	When rounding to the nearest hundred, 78,050 rounds to 78,100.	True / False
f	When rounding to the nearest hundred, numbers round down from 50.	True / False
g	You would be happy for your parents to use rounding for your weekly pocket money. You receive £14 pocket money.	True / False

6 A number rounded to the nearest thousand is 4,000. List at least 10 numbers it could be.

Round and estimate – round to estimate

We often round numbers when we are estimating, when being close enough provides us with the information we need to make a decision or calculation.

1 **Work out estimates for the following problems. The first one has been done for you.**

a 29 × 11

| 30 | × | 10 | = | *300* |

b 19 × 22

| | × | | = | |

c 12 × 41

| | × | | = | |

d 32 × 51

| | × | | = | |

e 62 × 29

| | × | | = | |

f 21 × 39

| | × | | = | |

g 11 × 59

| | × | | = | |

h 41 × 39

| | × | | = | |

i 19 × 69

| | × | | = | |

2 **Circle the best estimate:**

a 52 + 39 =   20   90   200

b 70 × 29 =   2,100   210   40

c 299 + 415 =   70   500   700

d 812 − 325 =   50   500   600

e 39 × 80 =   50   320   3,200

f 310 + 99 =   4   40   400

g 395 − 198 =   2   20   200

> A handy way to quickly multiply large numbers with zeros is to:
>
> 1 Cross off the zeros   4̶0̶ × 2̶0̶ =
>
> 2 Perform the operation   4 × 2 = 8
>
> 3 Add EXACTLY the number of zeros you crossed off 8 + 00
>
>   40 × 20 = 800

REMEMBER

G 3

SERIES   TOPIC

Whole Numbers and Place Value

Round and estimate – round to estimate

Sometimes it is best to round to a known fact rather than follow the normal rounding rules.

For example: $637 \div 9 = \boxed{?}$

If we round 637 to 630 instead of 640 we get $630 \div 9 = \boxed{70}$

This is easier to work out in our heads because we know the division fact: $63 \div 9 = 7$

3 Estimate the answer to the following division questions. The first one has been done for you.

a $329 \div 8 = \boxed{320} \div \boxed{8} = \boxed{40}$

b $487 \div 6 = \boxed{} \div \boxed{} = \boxed{}$

c $427 \div 7 = \boxed{} \div \boxed{} = \boxed{}$

d $367 \div 6 = \boxed{} \div \boxed{} = \boxed{}$

e $568 \div 8 = \boxed{} \div \boxed{} = \boxed{}$

f $729 \div 9 = \boxed{} \div \boxed{} = \boxed{}$

4 Hayley and Jack estimated answers to some calculations. Circle the most useful estimate:

Calculation	Hayley	Jack
a 12 of you go to a restaurant. The set price is £18 a head. What will the bill roughly be?	£200	£300
b You want to buy a new MP3 player that costs £157 and 5 songs from iTunes at £1.69 each. You have £250. Can you do it?	Yes – £250	Yes – £170
c You travel 365 km on one day, 478 km the next, and 541 the next. Roughly how far have you travelled altogether?	1,400 km	1,000 km
d 94 divided by 9 equals	3	10
e 47 + 32 + 67 =	150	800
f You have £32. A packet of lollies costs £2.95. Roughly how many packets can you buy with your money?	10	7
g 1,020 × 58 =	50,000	60,000

Getting ready

Your very demanding employer has decided he wants to bathe in lemonade as he believes the bubbles and sugar will make him young and attractive again. You think it will take more than lemonade, but you do his bidding anyway.

What to do

Using only a pencil and paper, work out the approximate number of 375 mL cans you will need to fill the 265 litre bathtub. His Lordship hates wastage, so you need to be as close as you can with your estimate.

Think of a strategy. Try it out. Are you on the right track?

Compare your answer with that of a friend. Are your answers similar? If not, discuss how each of you solved it, and work together to see if you can come up with an answer you both agree on.

> This activity requires you to estimate, not to work out exact figures.
>
> Perhaps a table or list may help.
>
> What about converting the quantities so that they are the same?

REMEMBER

What to do next

Can you get closer with your estimate? The more accurate you are, the fewer cans are used.

Whole Numbers and Place Value

Round and estimate word problems   solve

Solve these problems

a Dixie earned £10,433 in her first year as a singer. The next year
her career took off and she earned £107,420. In the following
year she raked in a cool £822,000. What were her earnings
over the 3 years to the nearest ten thousand pounds?

_____

b Sadly for Dixie, success is fickle, and her career took a nosedive. In the fourth
year, she made only £10,000 and had spent all but £100,000 of her previous
earnings. The tax office then decided she owed £150,000 in back taxes. Will she
have to go into debt to pay them back? If so, by how much?

_____

c Angus and his brothers are saving for a speed boat. Angus has £2,878, Richard has
£1,790, and Jack has £4,213. The boat costs £15,000. Approximately how much
more money do they need?

_____

d Jack has changed his mind about buying the speed boat. Instead he decides to
join a get rich quick scheme that requires just £4,000 from him as a joining fee.
Angus and Richard ask their cousin Fred to take Jack's place. Fred puts in £2,000
to the boat fund.

How much more money do they now need to buy the speed boat?

_____

Which information provided in the story is irrelevant to solving the problem?

_____

_____

How long before Jack regrets his decision?

_____

e Belle wants to buy 11 mini-chocolate bars. They each cost 80p.
She estimates this will cost her £10. Is this a reasonable estimate?

_____

f Dion goes for a run 5 days a week. Each run is 5 km long. He tells his mates he
runs about 50 km a week. Is this a reasonable estimation or is he just bragging?
Explain your thinking:

_____