**KING EDWARD VI
NORTHFIELD
SCHOOL FOR GIRLS**

Educational excellence for our City

'Educating Girls for the Future'

Parents, pupils and teachers guide to numeracy and help with mathematics.

VLE

moodle

Student > Home Study > Numeracy

Numbers and basic rules of Calculation

Reading and writing numbers

Pupils are encouraged to write numbers clearly, particularly ones which could be mistaken for a 7 (i.e. 1), and continental sevens (7) should be discouraged.

Pupils are encouraged to use spaces rather than commas between groups of three figures, eg. 34 000 not 34,000 (*See Question (A) in the Appendix to test yourself*)

In reading figures pupils should know the final three figures are read as they are written: hundreds, tens and units. The next group of three are thousands and the next group of three are millions.
E.g: 3 027 251 is three million, twenty seven thousand, two hundred and fifty one.

Number lines can be used for performing addition and subtraction. This is particularly encouraged for weaker or less confident pupils, when starting to teach negative number and/or to help check answers. Examples for using a number line are on the next page.

subtraction
go this way

addition
go this way

-9 -8 -7 -6 -5 -4 -3 -2 -1   1   2   3   4   5   6   7   8   9

0
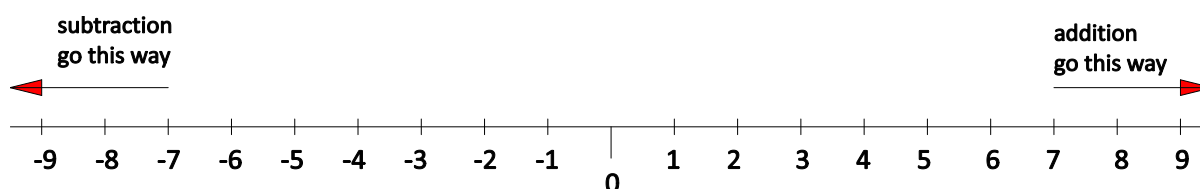
Please avoid this bad habit:

Please *do not* say that to find answers to the 10x tables is to 'add a 0'.
i.e. 10 x 12.1 is *not* 12.10
Moving the decimal point a place (when multiplying or dividing by 10) is better, but the decimal points in columns *must* line up. (It's better to think of the decimal point staying in one place and the numbers moving instead)
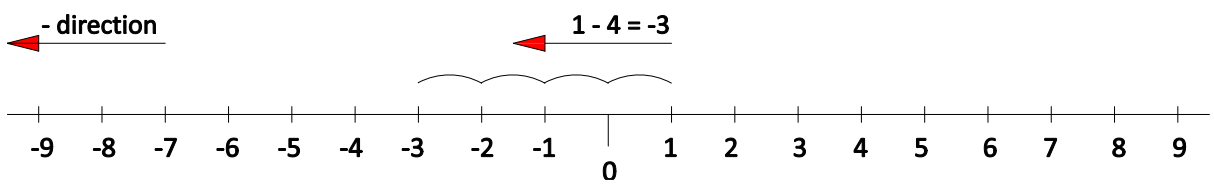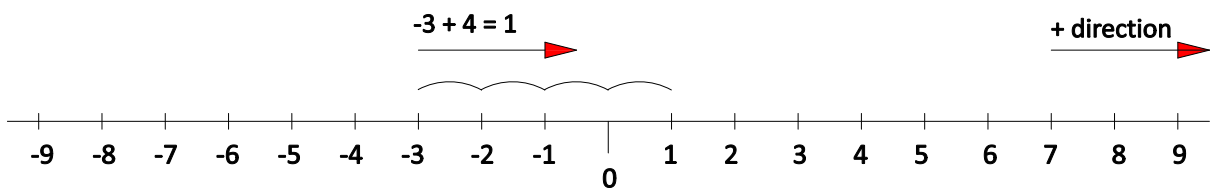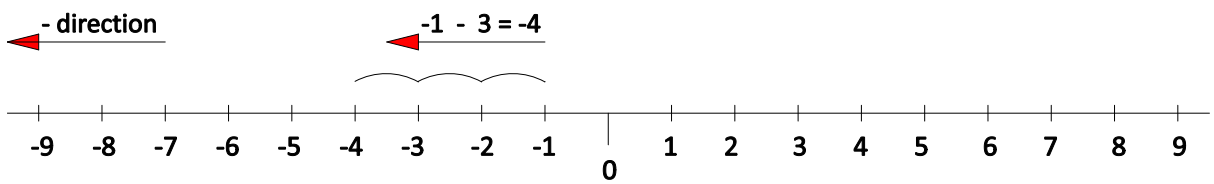
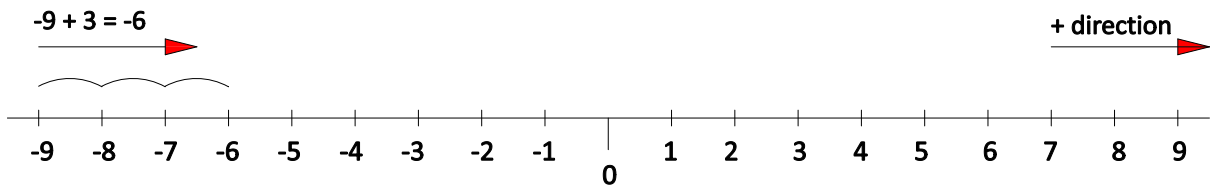**Please use the = sign correctly**
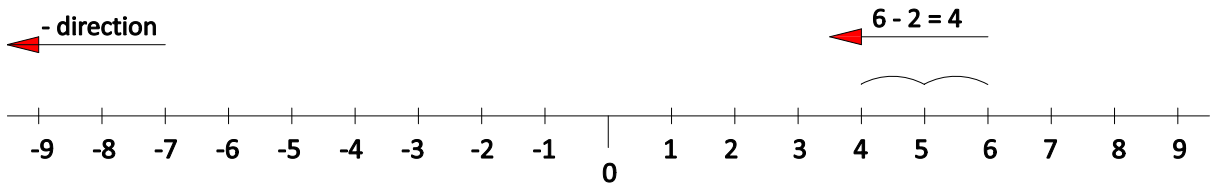
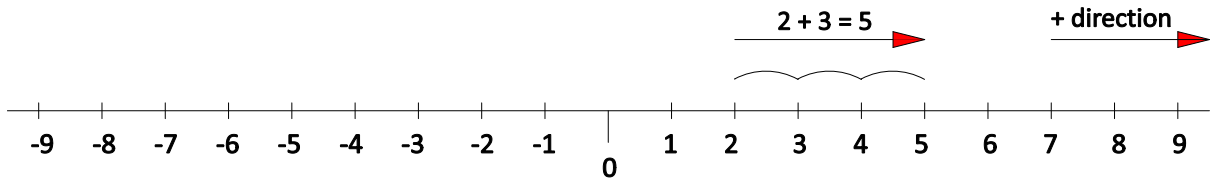It is important to use the ' = ' sign correctly, especially when a sequence of calculations is being done.

For example   5 x 4 = 20
                    20 + 3 = 23
                    23 – 8 = 15   is correct.

But   5 x 4 = 20 + 3 = 23 – 8 = 15   is incorrect.

The equal sign should only be used if both sides of an operation have the same value.
Clearly 5 x 4 = 20 + 3 is not true.

Number line examples:

2 + 3 = 5 + direction

-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9

- direction 6 - 2 = 4

-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9

-9 + 3 = -6 + direction

-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9

- direction -1 - 3 = -4

-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9

-3 + 4 = 1 + direction

-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9

- direction 1 - 4 = -3

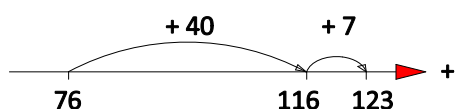-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9

Addition

There are four methods of doing addition calculations. Each method builds on pupil's ability and understanding.

Method 1: Visual / number line

Skill: counting on

47 + 76 = 123

First add four lots of 10s (+40).
Then add 7 units.

Method 2: Partitioning

Skill: understanding values and using columns. Make sure units line up & tens line up tens &

47 + 76 = 40 + 70 + 7 + 6 = 110 + 13 = 123

47	=	40 + 7
+76	=	70 + 6
		110 + 13 = 123

Partition numbers into tens + units.
Add groups of tens.
Add units.
Add together tens and units.

Method 3: Expanded Column Method

Skill: units first, then 10's, then 100's…add units to units, then tens to tens etc., separately

47
+76
 13
110
123

Add units to units, then…
Add tens to tens.
Complete the sum.
Emphasis on the addition of tens as 40 + 70, not 4 +7.

Method 4: Column Method

Skill: reducing the amount of workings and best for complex calculations.

47	366	366	47.6
+76	+458	+ 1234	+76.6
123	824	1600	124.2
1 1	1 1	1 1	1 1

Add units first.
Carry the tens
Add *all* tens next (including the carry)

(*See Question (B) in the Appendix to test yourself. Try each method and chose a method you prefer*)
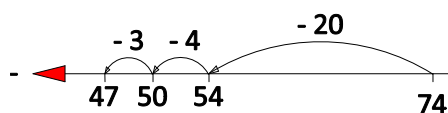
Subtraction

Warning to parents and teachers: If you demonstrate the column method please *do not* use a 'paying back' method *you* might have been taught at school! The pupil will not have seen this.

Like addition there are several methods that can be used to develop skill and understanding.

Method 1a: Visual / number line
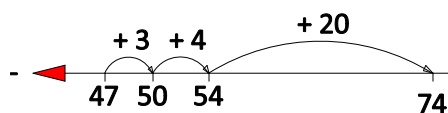
74 - 27 = 47

Take away the tens.
Then take away groups of units.
Encourage fewer steps with practice.

Method 1b: Counting Up

Counting up shows that subtraction is the same as the **difference** between two numbers.

74 - 27 = 47

Start with the smaller number.
Add on units and tens to make the bigger number.

Method 2: Partitioning

Skill: Encourages pupils to deal with tens and units separately.

$74 - 27 = 74 - 20 - 7$ $81 - 57 = 81 - 50 - 7$

       $74 - 20 = 54$ $81 - 50 = 31$

           $54 - 7 = 47$ $31 - 7 = 24$

Split the second number into tens and units and do two simpler calculations.

Method 3: Expanded Column Method

Skill: Consider hundreds, tens and units in sequence, and start to use columns.

$567 - 123$ $=$ $500 + 60 + 7$

                           $- 100 + 20 + 3$

                       $400 + 40 + 4$ $= 444$

Encourage to say $60 - 20$ rather than $6 - 2$.

Then we can start to re-partition numbers ('borrowing' a ten):

                                          60   14

$74 - 27$ $=$ $70 + 4$ $\bcancel{70} + 4$

                          $- 20 + 7$ $- 20 + 7$

                                   $40 + 7 = 47$

As 7 can't be taken from 4 a ten is borrowed to make it 14 instead.

Method 4: Column Method

The compact column method requires mental partitioning of numbers rather than written.

```
  500 + 60 + 7                    567
- 100 + 20 + 3     becomes      - 123
  400 + 40 + 4                    444
```

> Encourage to say 60 – 20 rather than 6 – 4.

Often, 'borrowing' from the next column might be necessary:

563 – 271 = 292

```
    400   160                     4 16
  500 + 60 + 3                    5 6 3
- 200 + 70 + 1     becomes      - 2 7 1
  200 + 90 + 2                    2 9 2
```

> 70 cannot be subtracted from 60 here, so one hundred is borrowed to make is 160 (or 16 tens).

(*See Question (C) in the Appendix to test yourself. Try each method and chose a method you prefer*)

> **In arithmetic make sure units line up with each other, and tens line up with each other, and hundreds, and the decimal point!**
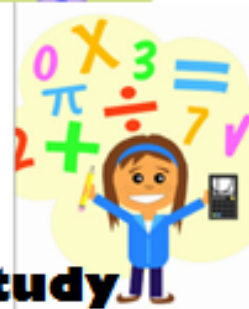
Numeracy at NSG

Mental Arithmetic
Try arithmetic problems in class...

1. First in your head.

2. Second on paper.

3. Lastly with a calculator.

See Moodle > Student > Home Study

Multiplication (simple methods):

Initial Learning

Learn to count in 2's, 5's and 10's

Step 2: Visual

Using arrays or grids.

3 x 4 = 12   and   4 x 3 = 12

(or you can explore the relationship
 between multiplication and division:
 12 ÷ 4 = 3   and   12 ÷ 3 = 4).

Step 3: Apply the Rules for Multiplying by 10, 100, 1000 etc.

Pupils should know that the 10 times table is **NOT** just 'adding a zero'.
Using a place value chart helps pupils understand that the digits move one place when multiplying by 10, two places for 100 etc. *The decimal point doesn't move*.

6.3 x 10 =

Hundreds	Tens	Units	.	tenths
		6	.	3
	6	3		
		6	.	3
6	3	0	.	0

(Moves one place, number gets bigger)

6.3 x 100

=

(Moves two places)

Pupils can   also begin to understand
here that dividing by 10 is also moving one place, just to the right**.** (*See Question (D) in the Appendix to test yourself)*

Step 4a: Partitioning

By partitioning the number you can multiply each part separately:

48 x 6   becomes
40 x 6 = 240   (using knowledge of 4 x 6)
 8 x 6 = 48
        = 288

Multiplication (more advanced methods):

Step 4b: Grid Method

An alternative way of organising the partitioning method…
Many people prefer this method over any other and is perfectly acceptable.
If your head hurts you can stop after this!

```
         6
   8 |  48
  40 | 240
     | 288
```

It is a useful method for more useful calculations.

```
   x |  30 |   6 |
  20 | 600 | 120 | 720
   4 | 120 |  24 | 144
     |           | 864
```

Using the columns (from step/method 3) you can do decimals too.

Step 5: Expanded Column Method

The next stage is to represent the method of recording in columns.
For example:

```
     56                            286
   x 27                          x  29
     42    (from  7 x  6)          54   ( 9 x   6)
    350    (from  7 x 50)         720   ( 9 x  80)
    120    (from 20 x  6)        1800   ( 9 x 200)
   1000    (from 20 x 50)         120   (20 x   6)
   1512                          1600   (20 x  80)
      1                          4000   (20 x 200)
                                 8294
                                    2
```

Step 6: Short Multiplication

Here recording is reduced with carry digits below the line.
Keep on making errors using this method? Stick to 'Grid' or 'Expanded Column' methods instead.

```
        56
      x  27
       392        (56 x  7)
      1120        (56 x 20)
      1512
         1
```
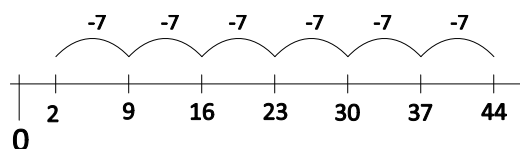
(*See Question (E) in the Appendix to test yourself*)

Division

Method 1: Visual or Chunking Method

$44 \div 7$
Repeated subtraction. How many 7's can you remove from 44?

$44 \div 7$

| | Keep on removing chunks of 7. |
| How many chunks of 7 can you remove? |
| How much is left over – the remainder? |

Answer: 6 jumps with 2 left over.   6 remainder 2.   6 r2

Method 2: Bigger Chunks

As the numbers get bigger it makes more sense to take bigger chunks…

$196 \div 6$

Instead of taking 6 each time, take 10 lots of 6 in one go before removing the last chunk.

```
   6 )196
     - 60          (remove 10 lots of 6)
      136
     - 60          (10 x 6)
       76
     - 60          (can still remove 10 more lots of 6)
       16
     - 12          (two more lots of 6)
        4
```

That's three times we've removed 10 lots of 6, so 3 x 10 = 30.
We then removed 2 more (so 32 lots of 6), and were left with 4 over.
Answer: 32 remainder 4   or   32 r4

You will soon realise that the fewer subtractions you have to do the quicker the method is.
So you will learn to work in even bigger chunks (useful for mental arithmetic):

```
   6 )196
     - 180         (remove 30 lots of 6, so 30 x 6)
       16
     -  12         (2 x 6)
        4
```

So, 32 lots of 6 remainder 4   or **32 r4**.

Method 3: Short Division ('Bus Stop').

345 ÷ 12

```
        2  8  r9
12 ) 3 4¹⁰5
```

Answer: 28 r9

a) 12 into 34 goes twice, remainder 10. Write '2'.
b) Write the remainder in front of the next digit.
c) 12 goes in to 105 eight times, remainder 9.

Again. We'll do 584 ÷ 4

```
      1 4 6
4 ) 5¹8²4
```

Answer: 146

a) 4 goes into 5 once, remainder 1. Write '1'.
b) Carry the remainder in front of the next digit.
c) 4 goes into 18 four times remainder 2. Write '4'.
d) Carry the remainder in front of the next digit.
e) 4 goes in to 24 six times, no remainder.

(_See Question (F) in the Appendix to test yourself_)

Measuring

Numeracy at NSG

Measuring with a ruler
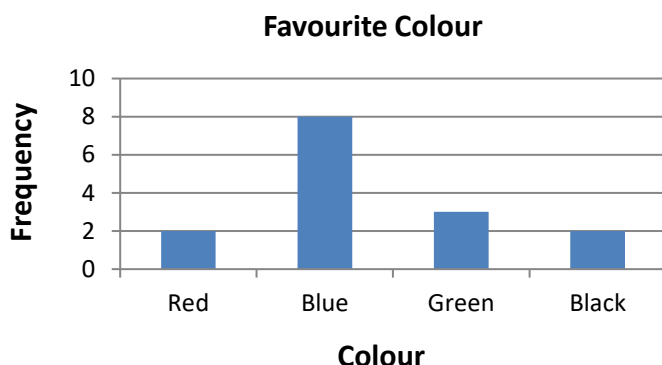
1. Start from the zero (not the end or the 1)

2. Know that 1cm = 10mm, 2cm = 20mm, 3.5cm = 35mm, 4.2cm = 42mm etc.

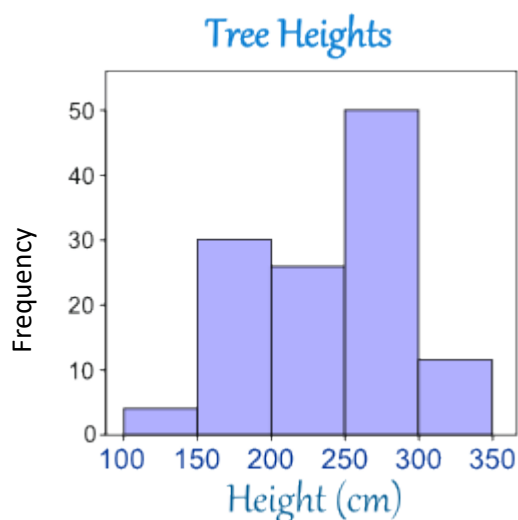**See Moodle > Student > Home Study**

Graphs / Charts

Bar charts

Favourite Colour

Bar charts:
1. **have gaps between the bars because it displays discrete data (categories)**
2. **Frequency means total**
3. **the modal colour in this bar chart is blue**

Histograms

Tree Heights

Height (cm)

Histograms:
1. **have <u>no</u> gaps between the bars because it displays continuous data (number ranges)**
2. **Frequency means total**
3. **the modal tree height is 250-300cm**

(See Question (J) in the Appendix to test yourself)

Rounding and Estimating

It is very easy to estimate and it is something you should do in both mental and written work. An estimate is a good approximation of a quantity that has been arrived at by judgement rather than guessing. It can be a quick way of checking your answers.

Rounding to the nearest ten, hundred or thousand

Remember the rule, 'Five or more'. Look at the next digit after the one to which you are correcting. If this is 5 or more, the digit before goes up.

To the nearest 10	34 becomes 30
	37 becomes 40
To the nearest 100	347 becomes 300
	357 becomes 400
To the nearest whole number	86.4 becomes 86
	86.6 becomes 87

(*See Question (G) in the Appendix to test yourself*)

How to use rounding to estimate:

e.g.1 $27 + (7.2 \times 9.6) \approx 30 + (7 \times 10) = 100$

e.g.2 $\dfrac{57 - 22}{4.56} \approx \dfrac{60 - 20}{5} = \dfrac{40}{5} = 8$

(*See Question (H) in the Appendix to test yourself*)

Rounding to 1 significant figure (s.f.)
Usually, the digits in a number, (not counting noughts at the beginning) are significant figures. Use the 'Five or more' rule.

681	has 3 s.f.	rounded to 1 s.f.:	700
39 784	has 5 s.f.	rounded to 1 s.f.:	40 000
13.06	has 4 s.f.	rounded to 1 s.f.:	10

The zeros must be included to keep the answer the correct size

(*See Question (I) in the Appendix to test yourself*)

Rounding decimal numbers which lie between 0 and 1 to 1 significant figure

0.900	rounded to 1 s.f.:	1
0.0076	rounded to 1 s.f.:	0.008

The zeros must be included to significant figure keep the answers the correct size

(*See Question (H) in the Appendix to test yourself*)

Numeracy at NSG

Estimate more accurately ...

side = 5.5cm
face = 30cm²
cube = 166cm²

track = 3.5 minutes
album = 45 minutes
CD = 12cm across

Weight = 60g
Length = 10cm
Calories = 260kcal

100 m =
0.1 km =
0.06 mile

400 m =
0.4 km =
0.25 mile

... by comparing with something you know.

See Moodle > Student > Home Study

Examples to help you estimate:

Length of pencil	= 10 cm
Width of desk	= ½ m
Bag of sugar	= 1 kg
Area of whiteboard	= 3 m²
Diameter of 1p coin	= 15 mm

Numeracy at NSG

Understand Proportion and Ratio

Example

Ratio
Ratio is a way of comparing two or more quantities.

Pastry contains flour and butter in a ratio of 2:1

Pastry Ratios
Pastry contains flour and butter in a ratio of 2:1
To make one batch of pastry we use 200g flour and 100g butter
If we use 400g flour how much butter would we need to use?
+ how much butter?

Remember the ratio is still 2:1

Paint Ratios
Purple paint contains red and blue paint in the ratio of 3:2

Paint Ratios
I have four cans of blue paint, how many cans of red paint do I need to make purple paint? Remember the ratio 3:2

Remember the ratio is still 3:2

See Moodle > Student > Home Study

Numeracy at NSG

Fractions, Decimals and Percentages
KNOW …

1/2 = 0.5 = 50%   = 4/6, 3/6...

1/4 = 0.25 = 25%   = 3/12, 2/8...

3/4 = 0.75 = 75%   = 15/20, 6/8...

1/10 = 0.1 = 10%   = 3/30, 10/100...

1/100 = 0.01 = 1%   = 2/200, 3/100...

See Moodle > Student > Home Study

Appendix

(A) Write these numbers with gaps in the correct places:
1. 4000 =
2. 165000=
3. 2354000=
4. 2700=

(B) Addition. Use either Method 1, 2, 3 or 4
1.   83 + 29=
2.   68 + 53=
3.   45 + 66=
4.   634 + 286=

(C) Subtraction. Use either Method 1a, 1b, 2, 3 or 4
1.   83 – 29=
2.   68 – 53=
3.   66 – 45=
4.   369 – 157=

(D) Multiplying by 10, 100 and 1000. Use a place value chart to help.
1.   5.3 x 10 =
2.   12.6 x 10 =
3.   4.25 x 100 =
4.   23.7 x 100 =
5.   6.987 x 1 000 =

thousands	Hundreds	Tens	Units	.	tenths	hundredths	thousandths
				.			
				.			
				.			
				.			
				.			

(E) Multiplication. Use either Step 4a, 4b, 5 or 6 (you must show your working out)

    1.   23 x 45 =
    2.   18 x 67 =
    3.   341 x 56 =
    4.   689 x 246=

(F) Division. Use either method 1, 2, or 3 (you must show your working out)

    1. 156 ÷ 3 =
    2. 1280 ÷ 5 =
    3. 882 ÷ 6 =
    4. 3816 ÷ 4 =
    5. 4992 ÷ 8 =

(G)   a. Round these numbers to the nearest 10
    1.   49 =   3.   25 =
    2.   83 =   4.   131 =

    b. Round these numbers to the nearest 100
    1.   324 =   3.   550 =
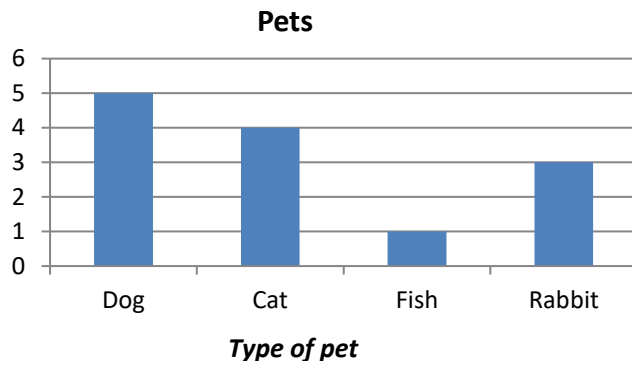   2.   867 =   4.   2 347 =

(H) Estimate the answers to these questions by using rounding.
    1.   63 + (39 – 28) =
    2.   (248 – 110) ÷ (27 + 21) =

(I) Round these numbers to 1 significant figures:
1.   23 =   4.   2300 =
2.   780 =   5.   6730 =
3.   512 =   6.   89 400 =

(J)

Pets

Type of pet

a. What is the modal pet?

b. How many pets are there in total?

c. What label is missing from the bar chart?