



## Mental methods

- Using mental strategies to solve word problems
- Using factors, powers and roots in solving problems
- Using known facts to derive unknown facts

Keywords

You should know

You should answer the questions in this topic without using a calculator.

explanation 1a

explanation 1b

explanation 1c

**1** Clare started these using some number facts she already knew.

Finish her calculations or find a way of your own to find the answers.

**a**  $34 \times 26 = (34 \times 25) + 34 = (34 \times 100 \div 4) + 34 =$

**b**  $82 \times 49 = (82 \times 50) - 82 =$

**c**  $102 \times 16 = (100 \times 16) + (2 \times 16) =$

**d**  $73 \div 25 = 73 \div 100 \times 4 =$

**e**  $91 \div 50 = 91 \div 100 \times 2 =$

**f**  $66 \div 8 = 66 \div 2 \div 2 \div 2 =$

**2** Find the answers to these using mental strategies for multiplying and dividing.

**a**  $67 \times 5$

**b**  $84 \times 50$

**c**  $36 \div 50$

**d**  $48 \times 25$

**e**  $89 \times 75$

**f**  $32 \times 12.5$

**g**  $192 \div 8$

**h**  $925 \div 25$

**i**  $47 \times 69$

**j**  $73 \times 82$

**3** Work these out.

**a**  $500 \times 8000$

**b**  $90 \times 600$

**c**  $56000 \div 700$

**d**  $300 \div 6000$

**e**  $40 \div 600$

**f**  $2500 \times 4000$

**4** Use your knowledge of place value to find the missing numbers.

**a**  $0.34 \times 0.1 = \square$

**b**  $8.6 \times 0.01 = \square$

**c**  $0.0675 \times 0.01 = \square$

**d**  $0.01 \times \square = 9.2$

**e**  $0.6 \div 0.1 = \square$

**f**  $0.017 \div 0.01 = \square$

**g**  $4.28 \div 0.01 = \square$

**h**  $\square \div 0.1 = 20.09$

**i**  $64 \div \square = 6400$

**5** Work these out.

**a**  $0.36 \times 0.03$

**b**  $600 \times 0.9$

**c**  $4.2 \div 6$

**d**  $42 \div 0.07$

**e**  $0.056 \times 0.02$

**f**  $8400 \div 0.03$

**6** Given that  $3.2 \times 48 = 153.6$ , find

**a**  $320 \times 480$

**b**  $0.32 \times 4.8$

**c**  $0.032 \times 480$

**d**  $1536 \div 3.2$

**e**  $1.536 \div 48$

**f**  $153.6 \div 4.8$

**7** Find three calculations that give each answer.

**a**  $\square \times \square = 13.2$

**b**  $\square \div \square = 0.036$

**c**  $\square \times \square \times \square = 1.44$

### explanation 2

**8** Write whether each number is divisible by the digit shown.

**a** 735 (by 3)

**b** 958 (by 4)

**c** 1038 (by 6)

**d** 4120 (by 8)

**e** 3762 (by 9)

**f** 80 314 (by 6)

**g** 73 053 (by 9)

**h** 824 (by 3)

**i** 92 896 (by 4)

**j** 101 836 (by 8)

**k** 473 615 (by 3)

**l** 632 026 (by 6)

**9** Which of these numbers are divisible by both 2 and 6?

**a** 84

**b** 326

**c** 432

**d** 573

**e** 812

**f** 948

**10** Which of these numbers are divisible by both 5 and 8?

**a** 96

**b** 520

**c** 645

**d** 355

**e** 1040

**f** 3908

**11** Which of the numbers 216, 504, 732, 756 and 1722 are divisible by each of these?

**a** 8

**b** 3

**c** 6

**d** 4

**e** 5

**f** 9

## explanation 3

**12** Work these out.

**a**  $12 \times -5$

**b**  $-12 \times -5$

**c**  $-12 \times 5$

**d**  $60 \div -12$

**e**  $-60 \div 12$

**f**  $-60 \div -12$

**13** Work out the answers to these.

**a**  $3 \times -7$

**b**  $-6 \times -4$

**c**  $-4 \times 8$

**d**  $5 \times -11$

**e**  $-6 \times -2$

**f**  $-12 \times 4$

**g**  $8 \div -2$

**h**  $-12 \div 3$

**i**  $-20 \div -5$

**j**  $-36 \div -3$

**k**  $24 \div -3$

**l**  $-48 \div -4$

**m**  $4 \times -20$

**n**  $-8 \times -12$

**o**  $45 \div -3$

**p**  $-120 \div -20$

**q**  $-12 \times -12$

**r**  $-500 \div 50$

**s**  $200 \div -20$

**t**  $50 \times -8$

**14** Copy and complete these multiplication tables.

**a**

$\times$	-5		8
		-24	-32
2			
		42	
-3			

**b**

$\times$		-9	-12
7			
	-45		
-11			
	150		-120

**15** Copy and complete these division tables. Divide the numbers in the top row by the numbers in the first column.

For example,  $108 \div -12 = -9$  has been done for you.

**a**

$\div$	108	-36	-72
3			
-12	-9		
18	6	-4	-4
-9			

**b**

$\div$		300	-90
-10			
	12	20	-6
2			
	-3	-5	

**16** Write down the next three numbers in each of these sequences.

**a** 5, -10, 20, ...

**b** -8, 24, -72, ...

**c** 7, -14, 28, ...

**d** -10, 10, -10, ...

**17** True or false?

**a**  $-48 \times -3 = 144$

**b**  $-72 \div -18 = -4$

**c**  $35 \times -5 = -175$

**d**  $175 \div -5 = -35$

**18** Work these out.

**a**  $3 \times -6 \times -5$

**b**  $-4 \times -7 \times -2$

**c**  $-8 \times 5 \times 9$

**d**  $-11 \times -3 \times 2$

**e**  $-2 \times 4 \times -5$

**f**  $3 \times 3 \times -3$

**g**  $-2 \times 4 \times 5$

**h**  $12 \div -4 \times 2$

**i**  $18 \times -2 \div -6$

**j**  $-20 \div -4 \times 2$

**k**  $-9 \times 3 \div -3$

**l**  $36 \div -4 \div -3$

**19** Work these out.

**a**  $\frac{-8 \times -4}{-2}$

**b**  $\frac{-24 \times 3}{-8}$

**c**  $\frac{56 \times -2}{14}$

**d**  $\frac{63 \times -4}{-9}$

**e**  $\frac{-9 \times -4}{3}$

**f**  $\frac{18 \times -2}{-9}$

**g**  $\frac{-45 \times -4}{5}$

**h**  $\frac{81 \times -3}{9}$

**i**  $\frac{-6 \times -8}{-6}$

**j**  $\frac{26 + -2}{-8}$

**k**  $\frac{-65 - -5}{5}$

**l**  $\frac{59 + -3}{8}$

**20** Work these out.

**a**  $(-6 + 11) \times -20$

**b**  $(7 + -19) \times (3 - 6)$

**c**  $(10 - 24) \div (7 - 9)$

**d**  $(9 \times -3) + (18 \div -2)$

**21 a** Find two negative numbers whose sum is -9 and product is 14.

**b** Find two negative numbers whose sum is -12 and product is 35.

**c** Find two numbers whose sum is -32 and product is 60.

**d** Find two numbers whose sum is -32 and product is 240.

**explanation 4**

**22** Work these out.

**a**  $(-3)^2$

**b**  $(2)^4$

**c**  $(5)^3$

**d**  $(-6)^2$

**e**  $(10)^3$

**f**  $(4)^3$

**23** Find the value of each of these expressions.

**a**  $(-4)^2 + 2^3$

**b**  $3^3 - (2)^4$

**c**  $(-5)^2 + 5^2$

**d**  $10^6 - (10)^3$

**e**  $20^2 + (-10)^2$

**f**  $5^2 - (-5)^2$

**24** Find these square roots.

**a**  $\sqrt{25}$

**b**  $\sqrt{81}$

**c**  $\sqrt{121}$

**d**  $\sqrt{144}$

**e**  $\sqrt{169}$

**25 a** Find two different numbers which, when squared, give the answer 16.

**b** Find a number which, when cubed, gives the answer 64.

**c** Find two square numbers with a difference of 13.

**26** In an experiment it was found that the number of bacteria cells doubled each hour as shown by this table.

Hour	Number of cells
0	$1 = 2^0$
1	$2 = 2^1$
2	$4 = 2^2$
3	$8 = 2^3$
...	...

How many cells will there be after these times?

**a** 6 hours

**b** 12 hours

**explanation 5**

**27** Work these out using the difference of two squares.

**a**  $6^2 - 5^2$

**b**  $12^2 - 8^2$

**c**  $20^2 - 11^2$

**d**  $9^2 - 7^2$

**e**  $12^2 - 9^2$

**f**  $20^2 - 14^2$

**g**  $16^2 - 15^2$

**h**  $100^2 - 50^2$

**28** The sign shows the cost of visiting a castle.

How much would a family of 2 adults and 2 children save by buying a family pass?

Adults £8.50 Children £4 Family pass (2 adults and 2 children) £22.50
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**29** Johnny's camper van was stuck in second gear.  
He could only travel at about 25 miles per hour.  
How long would it take him to travel 225 miles at this speed?

**30** A bird flies at an average speed of 30 kilometres per hour.  
How far will it fly in one minute at this speed?

**31** Imogen measured her kitten's tail. It was 5.6cm long.  
When the cat was fully grown its tail was 3 times longer.  
How long was the cat's tail then?



**32** Adesh bought 24 lollipops at £0.36 each for his son's birthday party.  
How much did he pay?

**33** A charity sold tickets for dinner with a celebrity at £70 each.  
The total amount received was £4900.  
How many tickets were sold?

**34** Bella bought scary masks for all her friends who came to a horror movie night.  
They cost £0.90 each and she spent £27 altogether.  
How many masks did she buy?

**35** A toy train travels around a 50 m track.  
In one circuit of the track the wheels turn 200 times.  
What distance is travelled when the wheels turn just once?



- 36** Ramesh and Amber were given large identical bags of counters. Ramesh put his counters into piles of 3 and there were none left over. Amber put hers into piles of 4 and there were none left over. Which of these could have been the number of counters they had in the large bag?
- 78      128      192      270      288
- 37** There is a 0.6 chance that Emily will beat Tom in a tennis game. Out of 40 games, how many would you expect her to win?
- 38** Kalem wanted to make orange drink that was 10% concentrated juice. How many litres of concentrate would he need to make 0.26 litres of juice?
- 39** Forty years ago, Britain used pounds, shillings and pence. There were 20 shillings in a pound. A gallon of petrol cost about 7 shillings at that time. About how many pounds did a gallon of petrol cost?
- 40 a** If 625 out of 1000 of people in a particular town travel to work alone, what percentage of the people travel to work with someone else?



- b** If about 1% of the population has no television, what fraction has at least one television?
- c** If 6.25% of households have no central heating, find the percentage of households that do have central heating.
- 41 a** 15 miles per hour is approximately 24 kilometres per hour. How many kilometres per hour faster is 40 miles per hour?
- b** A group of students has £82 to share between them. After spending £10, each of them receives £4.50. How many students were there?
- c** The mean number of CDs owned by a group of friends is 15. After buying 8 more CDs between them, they own 98 in total. How many friends are there in the group?