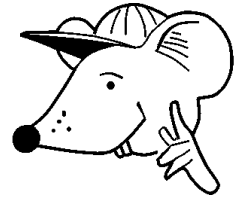




MATHEMATICS



N.S. Yr. 6 P.61

**Using related facts and doubling and halving.
Use Factors.**

Equipment

Paper, pencil, calculator.

MathSphere

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Concepts

This module is concerned with using facts about doubling and halving to simplify sums and aid in calculating the answers.

Types of problems covered:

To double 183, double 100, double 80 and then double 3.

To multiply by a number ending in 5, double the number ending in 5 and halve the other number. Eg. $45 \times 24 = 90 \times 12 = 1\ 080$

To multiply by 15, multiply by 10 and add on half the answer.

Eg. 15×180 . $10 \times 180 = 1\ 800$. Add another 900. Total 2 700.

To multiply by 25, multiply by 100 by shifting digits and then divide by 4.

Double the facts of one multiplication table twice to make another four times as large. Eg. double 6 times table twice to obtain 24 times table.

Given one lot of a number is the number itself, obtain values for $2\times$, $4\times$ etc by doubling.

Use combinations of facts to obtain more complex answers.

Eg. $32 \times 21 = (32 \times 16) + (32 \times 4) + (32 \times 1)$

Use halving simpler fractions of numbers to calculate harder fractions of numbers. Eg. Find $\frac{1}{12}$ of 480. First find $\frac{1}{3}$ of 480 and then halve the answer and halve again.

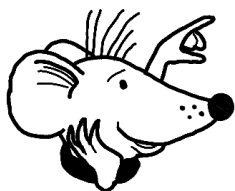
Similarly with twentieths etc.

Use factors to help in multiplication and division sums.

Eg. $42 \times 18 = 42 \times 3 \times 3 \times 2 = 126 \times 3 \times 2 = 378 \times 2 = 756$

Eg. $483 \div 21 = 483 \div 7 \div 3 = 69 \div 3 = 23$

As much of this work as possible should be done mentally, but some will have to be done on paper or the results recorded on paper, even if the working is done mentally.



If we want to double a number such as **243**, we can double the **200**, double the **40** and then double the **3**.

1. Try doubling these numbers using this idea:

a. 136 b. 335 c. 241 d. 443 e. 164 f. 216 g. 315 h. 446

2. Try doubling these more difficult numbers using this idea:

a. 456 b. 375 c. 286 d. 394 e. 428 f. 417 g. 318 h. 572

We can do the same thing with halving.
Half of **952** is:
half of **900** add half of **50** add half of **2**.
 $= 450 + 25 + 1$
 $= 476$



3. Try halving these numbers using this idea:

a. 884 b. 432 c. 186 d. 428 e. 248 f. 520 g. 734 h. 282

4. Try halving these more difficult numbers using this idea:

a. 678 b. 962 c. 898 d. 638 e. 744 f. 980 g. 456 h. 586

5. Using these ideas, see how quickly you can work out these little beauties!

a. 359×2 b. 256×2 c. $948 \div 2$ d. 373×2 e. $874 \div 2$
f. $634 \div 2$ g. 623×2 h. 365×2



Don't forget, if we want to double a number such as **176**, we can double the **100**, double the **70** and then double the **6**.

1. Try doubling these numbers using this idea:

a. 361 b. 246 c. 153 d. 437 e. 355 f. 247 g. 332 h. 428

2. Try doubling these more difficult numbers using this idea:

a. 468 b. 385 c. 464 d. 428 e. 376 f. 468 g. 499 h. 587

We can do the same thing with halving.
Half of **896** is:
half of **800** add half of **90** add half of **6**.
= **400 + 45 + 3**
= **448**



3. Try halving these numbers using this idea:

a. 846 b. 654 c. 374 d. 468 e. 856 f. 276 g. 862 h. 264

4. Try halving these more difficult numbers using this idea:

a. 946 b. 752 c. 998 d. 634 e. 796 f. 498 g. 776 h. 954

5. Using these ideas, see how quickly you can work out these little beauties!

a. 254×2 b. 643×2 c. $356 \div 2$ d. 725×2 e. $958 \div 2$
f. $676 \div 2$ g. 778×2 h. 586×2

When we are multiplying by a number ending in **5**, we can double this number and halve the other before multiplying: **84×45 is: $42 \times 90 = 3780$**

- 1. a.** 48×25 **b.** 24×35 **c.** 26×45 **d.** 22×35 **e.** 14×45
2. a. 54×15 **b.** 68×5 **c.** 82×35 **d.** 86×25 **e.** 42×25
-

If one number in a multiplication sum is even, we can halve it, multiply and double the answer.

Eg. **46×14** . Halve **14** and do the sum **$46 \times 7 = 322$**

Now double the answer **$\longrightarrow 644$**

- 3. a.** 22×31 **b.** 36×17 **c.** 22×24 **d.** 15×18 **e.** 43×16
4. a. 17×16 **b.** 21×24 **c.** 36×22 **d.** 35×16 **e.** 28×14
-

To multiply a number by **15**, multiply by **10** and add on half the answer.

Eg. **26×15** . Work out **$26 \times 10 = 260$**

Now add on half the answer. **$260 + 130 = 390$**

- 5. a.** 24×15 **b.** 36×15 **c.** 15×66 **d.** 15×42 **e.** 46×15
6. a. 28×15 **b.** 15×38 **c.** 15×35 **d.** 15×83 **e.** 95×15
-

To multiply a number by **25**, multiply by **100** and then divide the answer by **4**.

Eg. **84×25** . Work out **$84 \times 100 = 8\,400$**

Now divide by **4** the answer. **$8\,400 \div 4 = 2\,100$**

- 7. a.** 24×25 **b.** 36×25 **c.** 64×25 **d.** 25×86 **e.** 32×25
8. a. 73×25 **b.** 38×25 **c.** 25×46 **d.** 25×25 **e.** 54×25

When we are multiplying by a number ending in **5**, we can double this number and halve the other before multiplying: 72×35 is: $36 \times 70 = 2\,520$

1. a. 26×15 b. 44×25 c. 32×35 d. 46×45 e. 28×25
2. a. 48×35 b. 32×45 c. 54×5 d. 64×15 e. 36×35
-

If one number in a multiplication sum is even, we can halve it, multiply and double the answer.

Eg. 27×16 . Halve **16** and do the sum $27 \times 8 = 216$

Now double the answer $\longrightarrow 432$

3. a. 34×12 b. 22×11 c. 34×8 d. 18×24 e. 15×18
4. a. 29×12 b. 33×18 c. 23×18 d. 27×16 e. 17×18
-

To multiply a number by **15**, multiply by **10** and add on half the answer.

Eg. 32×15 . Work out $32 \times 10 = 320$

Now add on half the answer. $320 + 160 = 480$

5. a. 34×15 b. 28×15 c. 15×54 d. 15×32 e. 24×15
6. a. 37×15 b. 15×19 c. 15×23 d. 15×75 e. 84×15
-

To multiply a number by **25**, multiply by **100** and then divide the answer by **4**.

Eg. 76×25 . Work out $76 \times 100 = 7\,600$

Now divide by **4** the answer. $7\,600 \div 4 = 1\,900$

7. a. 48×25 b. 24×25 c. 14×25 d. 25×12 e. 16×25
8. a. 82×25 b. 93×25 c. 25×27 d. 15×25 e. 62×25



We can use **factors** to develop the ideas we have been looking at.

Yes! If we want to **multiply** by **21**, we can multiply by **7** and then by **3**.

$$\begin{aligned}\text{Eg. } 17 \times 21 &= 17 \times 7 \times 3 \\ &= 119 \times 3 \\ &= 357\end{aligned}$$

1. Try multiplying these numbers using **factors**:

- a. 23×15 b. 17×18 c. 38×15 d. 45×27
e. 28×21 f. 18×18 g. 34×21 h. 35×17



2. Try multiplying these more difficult numbers using **factors**:
(Use a calculator for the multiplication part)

- a. 49×77 b. 63×45 c. 34×18 d. 47×14
e. 56×35 f. 63×24 g. 18×16 h. 35×35

We can do something similar with **division**.
If we want to divide by **18**, we can divide by **3** and then divide by **6**.

$$\text{Eg. } 270 \div 18 = 270 \div 3 \div 6 = 15$$

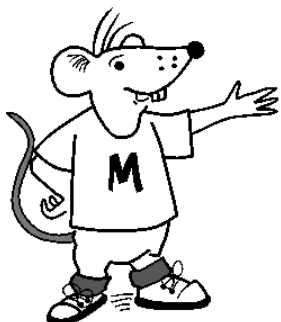


3. Try dividing these sums using **factors**:

- a. $360 \div 18$ b. $475 \div 25$ c. $396 \div 18$ d. $72 \div 9$ e. $220 \div 20$ f. $84 \div 12$

Exhausting stuff, don't you think?





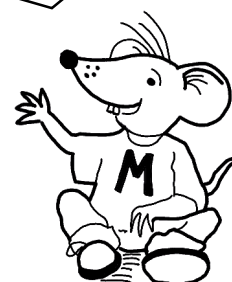
We can use **factors** to develop the ideas we have been looking at.

Yes! If we want to **multiply** by **24**, we can multiply by **8** and then by **3**.

$$\begin{aligned}\text{Eg. } 26 \times 24 &= 26 \times 8 \times 3 \\ &= 208 \times 3 \\ &= 624\end{aligned}$$

1. Try multiplying these numbers using **factors**:

- a. 32×15 b. 17×9 c. 24×21 d. 23×18
e. 32×12 f. 45×12 g. 64×15 h. 18×18



2. Try multiplying these more difficult numbers using **factors**:
(Use a calculator for the multiplication part)

- a. 237×28 b. 143×15 c. 524×24 d. 235×21
e. 432×35 f. 154×36 g. 452×45 h. 237×28

We can do something similar with **division**.
If we want to divide by **35**, we can divide by **5** and then divide by **7**.

$$\text{Eg. } 560 \div 35 = 560 \div 5 \div 7 = 16$$



3. Try dividing these sums using **factors**:

- a. $120 \div 24$ b. $468 \div 18$ c. $360 \div 18$ d. $72 \div 9$ e. $120 \div 24$ f. $78 \div 26$

Just think - one day, you will be as good as we Maths Rats!



1. Write down the **six** times table in the **first** column.



Tables are really important.

$1 \times 6 = 6$	$1 \times 12 =$	$1 \times 24 =$
$2 \times 6 =$	$2 \times 12 =$	$2 \times 24 =$
$3 \times 6 =$	$3 \times 12 =$	$3 \times 24 =$
$4 \times 6 =$	$4 \times 12 =$	$4 \times 24 =$
$5 \times 6 =$	$5 \times 12 =$	$5 \times 24 =$
$6 \times 6 =$	$6 \times 12 =$	$6 \times 24 =$
$7 \times 6 =$	$7 \times 12 =$	$7 \times 24 =$
$8 \times 6 =$	$8 \times 12 =$	$8 \times 24 =$
$9 \times 6 =$	$9 \times 12 =$	$9 \times 24 =$
$10 \times 6 =$	$10 \times 12 =$	$10 \times 24 =$

I know, I know!

Now fill in the second and third columns by doubling and doubling again.

2. We can use the doubling method to work out big sums.

How far can you go with these patterns?

$$1 \times 31 = 31$$

$$1 \times 13 = 13$$

$$2 \times 31 =$$

$$2 \times 13 =$$

$$4 \times 31 =$$

$$4 \times 13 =$$

$$8 \times 31 =$$

$$8 \times 13 =$$

$$16 \times 31 =$$

$$16 \times 13 =$$

$$32 \times 31 =$$

$$32 \times 13 =$$

$$64 \times 31 =$$

$$64 \times 13 =$$

1. Write down the **nine** times table in the **first** column.

Do you see how you can easily work out harder tables if you know easier ones?

$1 \times 9 = 9$	$1 \times 18 =$	$1 \times 36 =$
$2 \times 9 =$	$2 \times 18 =$	$2 \times 36 =$
$3 \times 9 =$	$3 \times 18 =$	$3 \times 36 =$
$4 \times 9 =$	$4 \times 18 =$	$4 \times 36 =$
$5 \times 9 =$	$5 \times 18 =$	$5 \times 36 =$
$6 \times 9 =$	$6 \times 18 =$	$6 \times 36 =$
$7 \times 9 =$	$7 \times 18 =$	$7 \times 36 =$
$8 \times 9 =$	$8 \times 18 =$	$8 \times 36 =$
$9 \times 9 =$	$9 \times 18 =$	$9 \times 36 =$
$10 \times 9 =$	$10 \times 18 =$	$10 \times 36 =$



Now fill in the second and third columns by doubling and doubling again.

2. We can use the doubling method to work out big sums.

How far can you go with these patterns?

$$1 \times 23 = 23$$

$$1 \times 35 = 35$$

$$2 \times 23 =$$

$$2 \times 35 =$$

$$4 \times 23 =$$

$$4 \times 35 =$$

$$8 \times 23 =$$

$$8 \times 35 =$$

$$16 \times 23 =$$

$$16 \times 35 =$$

$$32 \times 23 =$$

$$32 \times 35 =$$

$$64 \times 23 =$$

$$64 \times 35 =$$

1. Look at this table:

$$\begin{aligned}1 \times 32 &= 32 \\2 \times 32 &= 64 \\4 \times 32 &= 128 \\8 \times 32 &= 256 \\16 \times 32 &= 512\end{aligned}$$

From this we can work out other multiples of 32.

Now, this is where you really need to concentrate!



If we want to work out 26×32 , we should notice that 26 is $16 + 8 + 2$.

So, 26×32 is $(16 \times 32) + (8 \times 32) + (2 \times 32)$

Easy as standing on your hands - I don't think!

From the table, we can see that:

$$16 \times 32 = 512, 8 \times 32 = 256 \text{ and } 2 \times 32 = 64.$$

$$\text{So } 26 \times 32 = 512 + 256 + 64 = 832$$



Now, you try this method with these sums.

The first has been done for you.

- a. $7 \times 32 = (4 \times 32) + (2 \times 32) + (1 \times 32) = 128 + 64 + 32 = 224$
- b. $12 \times 32 =$
- c. $25 \times 32 =$
- d. $30 \times 32 =$

We can find a twelfth of a number by halving a third of it and halving again.

Eg. A third of **132** is **44**.

Half of **44** is **22**

Half of **22** is **11**

So a twelfth of **132** is **11**.



1. Use this method to find a **twelfth** of these numbers:

a. 156 b. 84 c. 480 d. 2 160 e. 600 f. 720 g. 4 500 h. 168

2. Now use the same method to find a **twelfth** of these harder numbers:

a. 870 b. 648 c. 390 d. 252 e. 690 f. 840 g. 216 h. 966

We can find a **twentieth** of a number by dividing by ten and halving the answer.

Eg. A tenth of **760** is **76**.

Half of **76** is **38**

So a twentieth of **760** is **38**.



3. Use this method to find a twentieth of these numbers:

a. 480 b. 340 c. 230 d. 780 e. 540 f. 920 g. 380 h. 660

4. Now use the same method to find a twentieth of these harder numbers:

a. 370 b. 750 c. 130 d. 590 e. 450 f. 870 g. 346 h. 248

Answers

Page 3

1. a. 272 b. 670 c. 482 d. 886 e. 328 f. 432 g. 630 h. 892
2. a. 912 b. 750 c. 572 d. 788 e. 856 f. 834 g. 636 h. 1 144
3. a. 442 b. 216 c. 93 d. 214 e. 124 f. 260 g. 367 h. 141
4. a. 339 b. 481 c. 449 d. 319 e. 372 f. 490 g. 228 h. 293
5. a. 718 b. 512 c. 474 d. 746 e. 437 f. 317 g. 1 246 h. 730

Page 4

1. a. 722 b. 492 c. 306 d. 874 e. 710 f. 494 g. 664 h. 856
2. a. 936 b. 770 c. 928 d. 856 e. 752 f. 936 g. 998 h. 1 174
3. a. 423 b. 327 c. 187 d. 234 e. 428 f. 138 g. 431 h. 132
4. a. 473 b. 376 c. 499 d. 317 e. 398 f. 249 g. 388 h. 477
5. a. 508 b. 1 286 c. 178 d. 1 450 e. 479 f. 338 g. 1 556 h. 1 172

Page 5

1. a. 1 200 b. 840 c. 1 170 d. 770 e. 630
2. a. 810 b. 340 c. 2 870 d. 2 150 e. 1 050
3. a. 682 b. 612 c. 528 d. 270 e. 688
4. a. 272 b. 504 c. 792 d. 560 e. 392
5. a. 360 b. 540 c. 990 d. 630 e. 690
6. a. 420 b. 570 c. 525 d. 1 245 e. 1 425
7. a. 600 b. 900 c. 1 600 d. 2 150 e. 800
8. a. 1 825 b. 950 c. 1 150 d. 625 e. 1 350

Page 6

1. a. 390 b. 1 100 c. 1 120 d. 2 070 e. 700
2. a. 1 680 b. 1 440 c. 270 d. 960 e. 1 260
3. a. 408 b. 242 c. 272 d. 432 e. 270
4. a. 348 b. 594 c. 414 d. 432 e. 306
5. a. 510 b. 420 c. 810 d. 480 e. 360
6. a. 555 b. 285 c. 345 d. 1 125 e. 1 260
7. a. 1 200 b. 600 c. 350 d. 300 e. 400
8. a. 2 050 b. 2 325 c. 675 d. 375 e. 1 550

Page 7

1. a. 345 b. 306 c. 570 d. 1 215 e. 588 f. 324 g. 714 h. 595
2. a. 3 773 b. 2 835 c. 612 d. 658 e. 1 960 f. 1 512 g. 288 h. 1 225
3. a. 20 b. 19 c. 22 d. 8 e. 11 f. 7

Answers (Contd)**Page 8**

1. a. 480 b. 153 c. 504 d. 414 e. 384 f. 540 g. 960 h. 324
 2. a. 6 636 b. 2 145 c. 12 576 d. 4 935 e. 15 120 f. 5 544 g. 20 340 h. 6 636
 3. a. 5 b. 26 c. 20 d. 8 e. 5 f. 3

Page 9

1.

$1 \times 6 = 6$	$1 \times 12 = 12$	$1 \times 24 = 24$	$1 \times 31 = 31$	$1 \times 13 = 13$
$2 \times 6 = 12$	$2 \times 12 = 24$	$2 \times 24 = 48$	$2 \times 31 = 62$	$2 \times 13 = 26$
$3 \times 6 = 18$	$3 \times 12 = 36$	$3 \times 24 = 72$	$4 \times 31 = 124$	$4 \times 13 = 52$
$4 \times 6 = 24$	$4 \times 12 = 48$	$4 \times 24 = 96$	$8 \times 31 = 248$	$8 \times 13 = 104$
$5 \times 6 = 30$	$5 \times 12 = 60$	$5 \times 24 = 120$	$16 \times 31 = 496$	$16 \times 13 = 208$
$6 \times 6 = 36$	$6 \times 12 = 72$	$6 \times 24 = 144$	$32 \times 31 = 992$	$32 \times 13 = 416$
$7 \times 6 = 42$	$7 \times 12 = 84$	$7 \times 24 = 168$	$64 \times 31 = 1\,984$	$64 \times 13 = 832$
$8 \times 6 = 48$	$8 \times 12 = 96$	$8 \times 24 = 192$	etc	
$9 \times 6 = 54$	$9 \times 12 = 108$	$9 \times 24 = 216$		
$10 \times 6 = 60$	$10 \times 12 = 120$	$10 \times 24 = 240$		

Page 10

1.

$1 \times 9 = 9$	$1 \times 18 = 18$	$1 \times 36 = 36$	$1 \times 23 = 23$	$1 \times 35 = 35$
$2 \times 9 = 18$	$2 \times 18 = 36$	$2 \times 36 = 72$	$2 \times 23 = 46$	$2 \times 35 = 70$
$3 \times 9 = 27$	$3 \times 18 = 54$	$3 \times 36 = 108$	$4 \times 23 = 92$	$4 \times 35 = 140$
$4 \times 9 = 36$	$4 \times 18 = 72$	$4 \times 36 = 144$	$8 \times 23 = 184$	$8 \times 35 = 280$
$5 \times 9 = 45$	$5 \times 18 = 90$	$5 \times 36 = 180$	$16 \times 23 = 368$	$16 \times 35 = 560$
$6 \times 9 = 54$	$6 \times 18 = 108$	$6 \times 36 = 216$	$32 \times 23 = 736$	$32 \times 35 = 1\,120$
$7 \times 9 = 63$	$7 \times 18 = 126$	$7 \times 36 = 252$	$64 \times 23 = 1\,472$	$64 \times 35 = 2\,240$
$8 \times 9 = 72$	$8 \times 18 = 144$	$8 \times 36 = 288$	etc	
$9 \times 9 = 81$	$9 \times 18 = 162$	$9 \times 36 = 324$		
$10 \times 9 = 90$	$10 \times 18 = 180$	$10 \times 36 = 360$		

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- a. 224 b. 384 c. 800 d. 960

Page 12

1. a. 13 b. 7 c. 40 d. 180 e. 50 f. 60 g. 375 h. 14
 2. a. 72.5 b. 54 c. 32.5 d. 21 e. 57.5 f. 70 g. 18 h. 80.5
 3. a. 24 b. 17 c. 11.5 d. 39 e. 27 f. 46 g. 19 h. 33
 4. a. 18.5 b. 37.5 c. 6.5 d. 29.5 e. 22.5 f. 43.5 g. 17.3 h. 12.4