Multiplication and Division Strategies
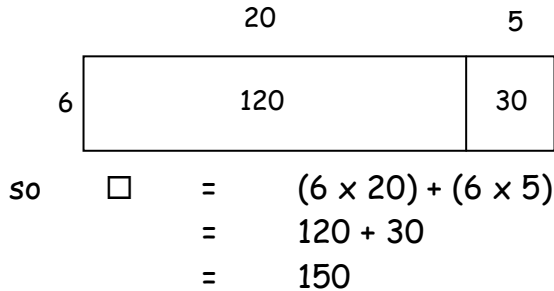
AC
EA
AA
AM
AP

Cross Products

We are learning to multiply multi-digit whole numbers

Exercise 1: It's Place Value but NOT as we know it!

Example: 25 × 6 = □, draw the rectangle to show this multiplication

so   □   =   (6 × 20) + (6 × 5)
   =   120 + 30
         =   150

What to do:

1)   Draw the appropriate rectangle like the one in the example and put in all the numbers.

2)   Write out the working for the problem, set out like the example above

1)	$13 \times 4 = \square$	(2)	$17 \times 6 = \square$	(3)	$19 \times 7 = \square$	(4)	$22 \times 3 = \square$
5)	$31 \times 9 = \square$	(6)	$4 \times 16 = \square$	(7)	$5 \times 17 = \square$	(8)	$8 \times 36 = \square$
9)	$7 \times 44 = \square$	(10)	$7 \times 43 = \square$				

Exercise 2: Into the unknown

Example: Find the value of the □ and the Δ for this diagram and write down the multiplication question AND answer that goes with the picture
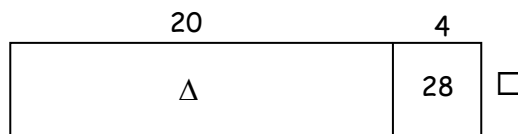
□ = 7 and so Δ = 140 and so the sum and answer must have been
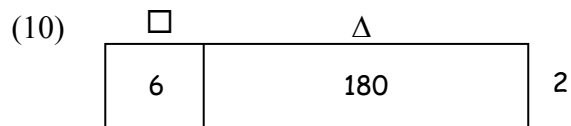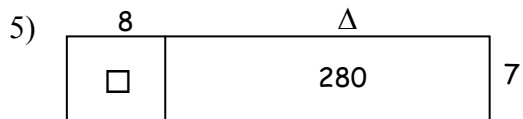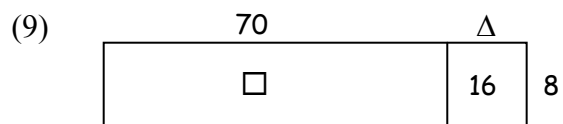
24 × 7 = 140 + 28
    = 168

What to do:

Find the value of the □ and the Δ for this diagram and write down the multiplication question AND answer that goes with the picture (set out like the example above)

2)

30	4
Δ	20	□

(7)

□	9
360	54	Δ

3)

Δ	3
90	□	9

(8)

10	Δ
□	36	4

4)

2	Δ
□	120	6

(9)

70	Δ
□	16	8

5)

8	Δ
□	280	7

(10)

□	Δ
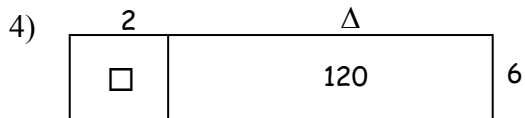| 6 | 180 | 2

Exercise 3: Mixing up the Unknowns

Example: Find the value of the □ and the Δ for this diagram and write down the multiplication question AND answer that goes with the picture

□	7
160	28	Δ

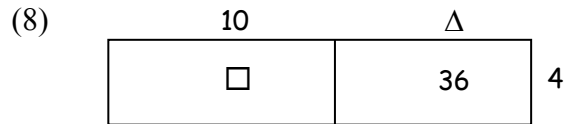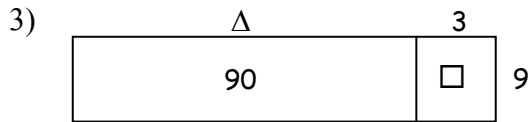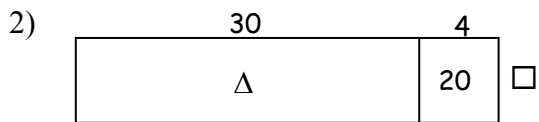Δ = 4 and so □ = 40 and so the sum and answer must have been
47 × 4 = 188

What to do:

Find the value of the □ and the Δ for this diagram and write down the multiplication question AND answer that goes with the picture (set out like the example above)
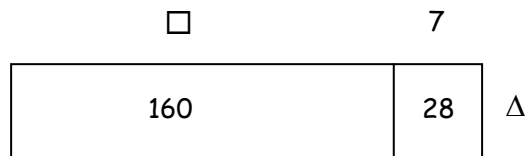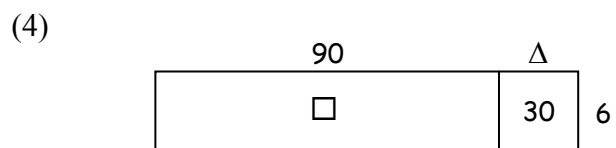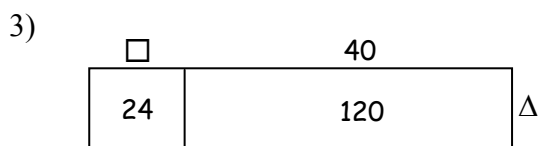
1)

□	7
120	28	Δ

(2)

□	2
300	12	Δ

3)

□	40
24	120	Δ

(4)

90	Δ
□	30	6

5)

	70	Δ	
	□	48	8

(6)

	9	Δ	
	□	240	3

7)

```
      9
Δ |  63  |
60 |  □  |
```

(8)

```
Δ |  180  |
9 |   □   |
       9
```

(9)

```
80 |  □  |
Δ  |  8  |
      2
```

(10)

```
      |  81  | Δ
90 |  □  |
        9
```
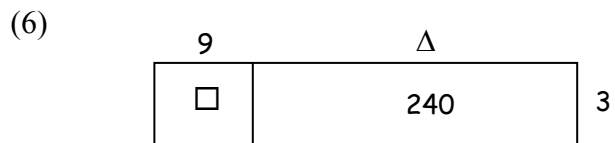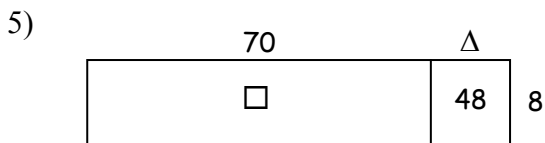
11)   Make up three problems of your own like the ones in this exercise.

Exercise 4: How does it work with Decimals?

Example: 2.5 x 3 = □, draw the diagram to show this multiplication and work out the answer
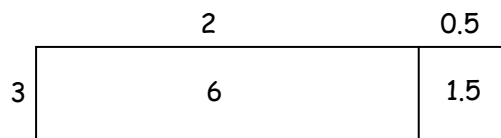
	2	0.5
3	6	1.5

so   □   =   (3 x 2) + (3 x 0.5)
   =   6 + 1.5
   =   7.5

What to do:
   1)   Draw the appropriate diagram like the one in the example and put in all the numbers.
   2)   Write out the working for the problem, set out like the example above

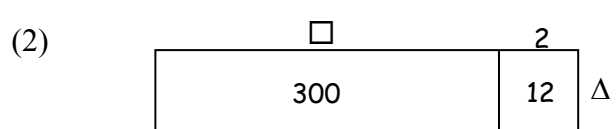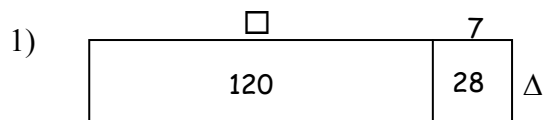1) $1.7 \times 3 = \square$ (2) $4.8 \times 4 = \square$ (3) $5.6 \times 7 = \square$ (4) $12.7 \times 9 = \square$

Find the value of the □ and the Δ for these diagrams and write down the multiplication question AND answer that goes with the picture.
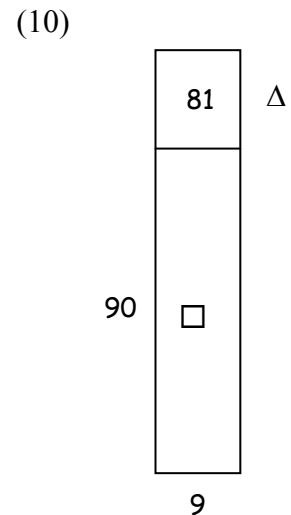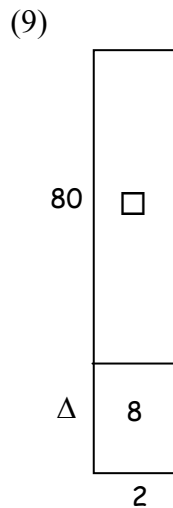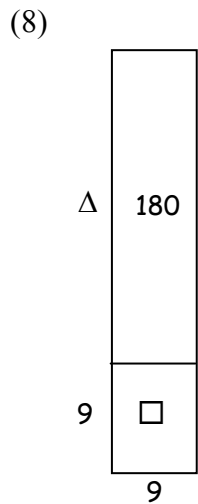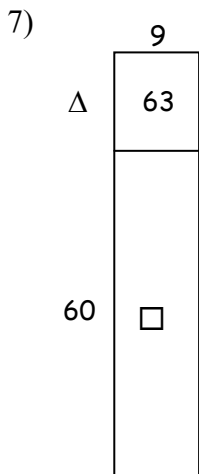
5)

	□	Δ	
	28	3.6	4

(11)

	40	0.3	
	□	2.7	Δ

6)

	□	Δ
24	1.8	3

(12)

0.2	50	
□	200	Δ

7)

	Δ	□
36	3.2	4

(13)

1	0.6	
Δ	□	3

8)

0.3	12	
□	Δ	5

(14)

	14	□
Δ	126	7.2

9)

0.1	Δ	
□	140	7

(15)

	19	Δ
□	2.7	3

10)

	□	0.4
240	3.2	Δ
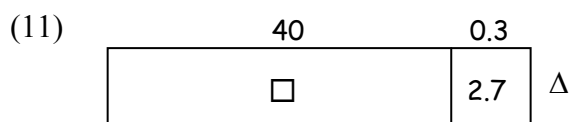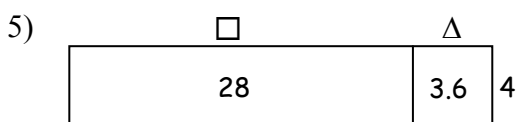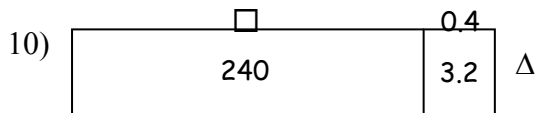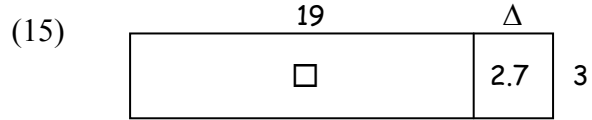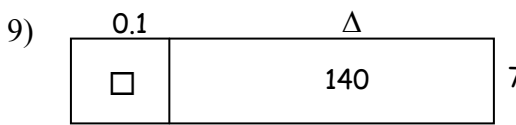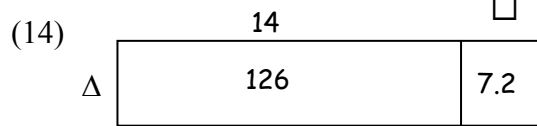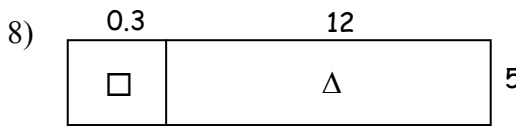
(16)   Make up three more problems of your own.

Exercise 5: More Rectangles

Example: 57 x 34 = □, draw the diagram to show this multiplication and work out the answer

50	7	
1500	210	30
200	28	4
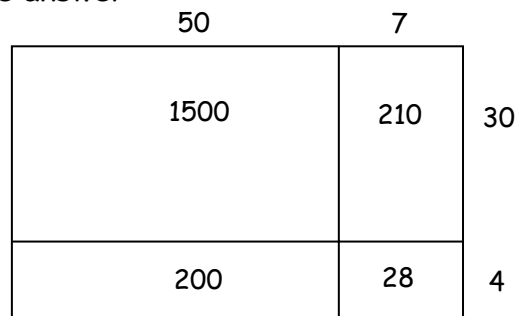
□   = (50 x 30) + (7 x 30) + (50 x 4) + (7 x 4)
     = 1500 + 210 + 200 + 28
     = 1938

What to do:

1)   Draw the appropriate diagram like the one in the example and put in all the numbers.
2)   Write out the working for the problem, set out like the example above

1)	$28 \times 62 = $ □	(2)	$32 \times 41 = $ □	(3)	$17 \times 56 = $ □	(4)	$25 \times 37 = $ □
5)	$14 \times 92 = $ □	(6)	$87 \times 63 = $ □	(7)	$74 \times 33 = $ □	(8)	$55 \times 55 = $ □
9)	$72 \times 86 = $ □	(10)	$97 \times 79 = $ □				

Exercise 6: The Second Dimension in the Decimal Zone

Example: 5.7 x 34 = □, draw the diagram to show this multiplication and work out the answer

	5	0.7	
	150	21	30
	20	2.8	4

□   = (5 x 30) + (0.7 x 30) + (5 x 4) + (0.7 x 4)
     = 150 + 21 + 20 + 2.8
     = 193.8

What to do:
1)   Draw the appropriate box diagram like the one in the example and put in all the numbers.
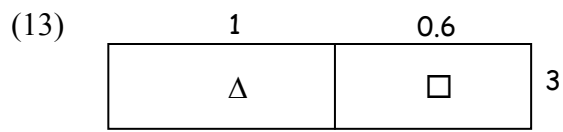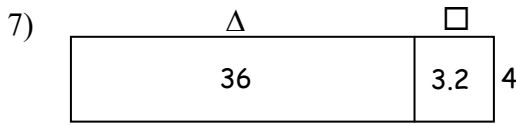2)   Write out the working for the problem, set out like the example above

1)	$8.6 \times 16 = \square$	(2)	$3.4 \times 34 = \square$	(3)	$1.2 \times 21 = \square$	(4)	$7.9 \times 86 = \square$
5)	$6.4 \times 63 = \square$	(6)	$57 \times 1.8 = \square$	(7)	$61 \times 3.9 = \square$	(8)	$17 \times 6.4 = \square$
9)	$92 \times 7.8 = \square$	(10)	$66 \times 6.6 = \square$				

Exercise 7 Finally ….. TWO DECIMALS

Example: 4.3 x 8.1 = □, draw the diagram to show this multiplication and work out the answer

	4	0.3
8	32	2.4
0.1	0.4	0.03

□ = (4 x 8) + (4 x 0.1) + (0.3 x 8) + (0.3 x 0.1)
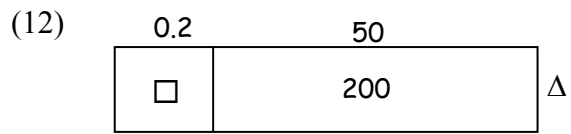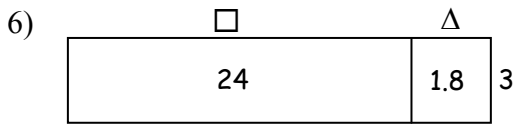 = 32 + 0.4 + 2.4 + 0.03
  = 34.83

What to do:
1)   Draw the appropriate diagram like the one in the example and put in all the numbers.
2)   Write out the working for the problem, set out like the example above

1)	$3.4 \times 5.7 = \square$	(2)	$4.6 \times 8.1 = \square$	(3)	$6.1 \times 9.1 = \square$	(4)	$5.2 \times 3.4 = \square$
5)	$6.8 \times 7.7 = \square$	(6)	$9.2 \times 1.9 = \square$	(7)	$4.7 \times 3.9 = \square$	(8)	$8.8 \times 9.7 = \square$
9)	$9.0 \times 8.6 = \square$	(10)	$12.3 \times 3.3 = \square$				

Exercise 8: The Unknown Zone

Example: Find the value of the □ and the △ for this diagram and write down the multiplication question AND answer that goes with the picture

| 8	△
56	4.2	7
□	0.12	0.2

△ = 0.6 and so □ = 1.6 and so
the sum and answer must have been
8.6 x 7.2   = 56 + 1.6 + 4.2 + 0.12
                   = 61.92

What to do
1)   Find the value of the □ and the △ for these diagrams and write down the multiplication question AND answer that goes with the picture.

1)

8	△
56	1.4	7
□	0.06	0.3

(2)

	8	△
0.4	3.2	0.08
6	□	1.2

(3)

	6	0.3
△	0.6	0.03
4	□	1.2

4)

	1	0.8
△	2	1.6
0.3	□	0.24

(5)

	6	0.7
□	4.9	7
3	0.35	△

(6)

	9	△
3	□	1.2
0.6	5.4	0.24

7)

△	0.5
36	3	6
1.8	□	0.3

(8)

	0.7	△
8	5.6	72
0.4	□	3.6

(9)

	0.6	7
3	1.8	□
0.9	△	6.3

Exercise 9: Word Problems

What to do:
  1)   Draw the appropriate diagram like for each question.
  2)   Write out the working for the problem and find the answer

1)   Anton's pool is 24m long. He keeps count of his total distance by counting laps. After 13 laps, how far has he swum?

2)   Pete's climbing rope is 17m long. He and his partner climb in 'pitches', which is one length of the rope. After 12 'pitches', how far has he climbed?

3)   Carpet costs $87 per metre. How much would it cost for 13m?

4)   Josh bets on a horse, which is paying $2.30 per dollar. He bets $6.00. How much does he win?

5)   A box of fruit weighs 3.2kg. There are 18 boxes on the trailer. What is the total weight of the fruit on the trailer?

(6)   Each carton of baked beans has 18 tins in it. Apu orders 23 cartons of baked beans. How many tins has he ordered?

(7)   Carpet in a sale is 1.6m wide. Kate buys 3.5m of this carpet. What is the area of the room that she is going to lay the carpet in?

(8)   Pete reckons that he does 36 sit-ups every time he goes to the gym. If this is so what will be the total number of sit-ups that he has done after 28 visits to the gym?

(9)   A small container of V-Pops has 49 in it. Mrs Jones has bought 16 of these containers this year. How many V-Pops has she bought?

(10)   One kilogram of a particular fruit $1.30 costs. If Kyle buys 7.8kg of the fruit. How much did it cost?

(11)   Write two word questions of your own.

Exercise 10: Investigation
Can this method (rectangles) be used for numbers in the 100's? Write five questions and show the diagram and working that would be used to find the answers.

Exercise 11: Moving to Algebra

Using the rectangle 6 x 4, try adding a length to both sides.

6

4   **6x4 =24**
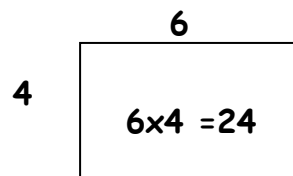
Adding three to both sides

	3	6
4	12	24
3	9	18
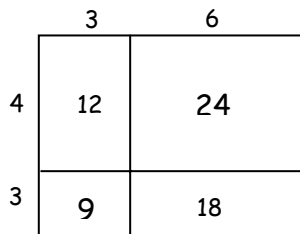
$(3 + 6) \times (4 + 3) = 12 + 24 + 9 + 18$

$= 63$

Now add x to both sides

	x	6
x	x^2	6x
4	4x	24
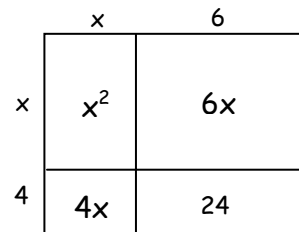
We can write this as :

$(x + 6)$ multiplied by $(x + 4)$

or $(x + 6)(x + 4)$

$= x^2 + 6x + 4x + 24$

$= x^2 + 10x + 24$

For each of the following draw a diagram, label it and do the calculation setting it out like the example above.

1) $(x + 4)(x + 2)$
2) $(x + 5)(x + 4)$
3) $(x + 2)(x + 9)$
4) $(x + 6)(x + 4)$
5) $(x + 8)(x + 2)$
6) $(x + 7)(x + 6)$
7) $(x + 5)(x + 3)$
8) $(x + 6)(x + 1)$
9) $(x + 4)(x + 4)$
10) $(x + 8)(x + 7)$

Can you do these without the diagram?

Cross products
Answers

Exercise 1

1) 13 x 4 = (10 x 4) + (3 x 4)
         = 40 + 12
         = 52

	10	3
4	40	12

2) 17 x 6 = (10 x 6) + (6 x 7)
         = 60 + 42
         = 102

	10	7
6	60	42

3) 19 x 7 = (10 x 7) + (9 x 7)
         = 70 + 63
         = 133

	10	9
7	70	63

4) 22 x 3 = (3 x 20) + (2 x 3)
         = 60 + 6
         = 66

	20	2
3	60	6

5) 31 x 9 = (9 x 30) + (1 x 9)
         = 270 + 9
         = 279

	30	1
9	270	9

6) 4 x 16 = (4 x 10) + (4 x 6)
         = 40 + 24
         = 64

	10	6
4	40	24

7) 5 x 17 = (5 x 10) + (5 x 7)
         = 50 + 35
         = 85

	10	7
5	50	35

8) 8 x 36= (8 x 30) +(8 x 6)
         = 240 + 48
         = 288

	30	6
8	240	48

9) 7 × 44= (7×40) + (7×4)
        = 280 + 28
        = 308

	40	4
7	280	28

10) 7 × 43 = (7×40) + (7×3)
        = 280 + 21
        = 301

	40	3
7	280	21

Exercise 2: Into the unknown

1)   △ = 60   □ = 3
2)   △ = 150   □ = 5
3)   △ = 10   □ = 27
4)   △ = 20   □ = 12
5)   △ = 40   □ = 56
6)   △ = 8   □ = 3
7)   △ = 6   □ = 60
8)   △ = 9   □ = 40
9)   △ = 8   □ = 560
10) △ = 90   □ = 3

Exercise 3: Mixing up the unknowns

1)   △ =4   □ = 30   37 × 4 =148
2)   △ = 6   □ = 50   52 × 6 = 312
3)   △ =3   □ = 8   48 × 3 = 144
4)   △ =5   □ = 540   95 × 6 = 570
5)   △ =6   □ = 560   76 × 8 =608
6)   △ =80   □ = 27   89 × 3 = 267
7)   △ =7   □ = 540   67 × 9 = 603
8)   △ = 20   □ = 81   29 × 9 = 261
9)   △ =4   □ = 160   84 × 2 = 168
10) △ =9   □ = 810   99 × 9 = 891

Question 4: How does it work with decimals

1)   1.7 × 3 = (1 × 7) + (0.7 × 7)
        = 3 + 4.9
        = 5.1

	1	0 .7
3	3	2.1

2) 4.8 x 4   = (4 x 4) + (4 x 0.8)
            = 16 + 3.2
            = 19.2

	4	0 .8
4	16	3.2

3) 5.6 x 7   = (5 x 7) +(0.6 x 7)
            = 35 + 4.2
            = 39.2

	5	0 .6
7	35	4.2

4) 12.7 x 9   = (9 x 12) + (9 x 0.7)
            = 108 + 6.3
            = 114.3

	12	0 .7
9	108	6.3

5) △ =0.9   ☐ = 7   7.9 x 4 = 31.6
6) △ =0.6   ☐ = 8   8.6 x 3 = 25.8
7) △ =9   ☐ = 0.8   9.8 x 4 = 39.2
8) △ = 60   ☐ = 1.5   12.3 x 5 = 61.5
9) △ =20   ☐ = 0.7   20.1 x 7 = 140.7
10) △ =8   ☐ = 30   30.4 x 8 = 243.2
11) △ =9   ☐ = 360   40.3 x 9 = 362.7
12) △ =4   ☐ = 0.8   50.2 x 4 = 200.8
13) △ =3   ☐ = 1.8   1.6 x 3 = 4.2
14) △ =9   ☐ = 0.8   14.8 x 9 = 133.2
15) △ =0.9   ☐ =57   19.9 x 3 = 59.7

Exercise 5: More rectangles

1)
28 x 62 = (20x60) +(8x60) + (20x2) +(8x2)
         = 1200 + 480 + 40 + 16
         = 1736

	20	8
60	1200	480
2	40	16

2)
32 x 41 = (30x40) + (2x40) +(30x1) + (2x1)
         = 1200 + 80 + 30 + 2
         = 1312

	30	2
40	1200	80
1	30	2

3)

17×56 = $(10 \times 50)+(7 \times 50)+(10 \times 6)+(7 \times 6)$
= 500 + 350 + 60 + 42
= 952

	10	7
50	500	350
6	60	42

4)

25×37 = $(20 \times 30)+(20 \times 7)+(5 \times 30)+(5 \times 7)$
= 600 + 140 + 150 + 35
= 925

	20	5
30	600	150
7	140	35

5)

14×92 = $(10 \times 90)+(10 \times 2)+(4 \times 90)+(4 \times 2)$
= 900+20+360+8
= 1288

	10	4
90	900	360
2	20	8

6)

87×63 = $(80 \times 60)+(80 \times 3)+(7 \times 60)+(7 \times 3)$
= 4800+240+420+21
= 5481

	80	7
60	4800	420
3	240	21

7)

74×33 = $(70 \times 30)+(70 \times 3)+(30 \times 4)+(3 \times 4)$
= 2100+210+120+12
= 2442

	70	4
30	2100	120
3	210	12

8)

55x55   = (50x50)+(50x5)+(50x5)+(5x5)
           = 2500+250+250+25
           = 3025

	50	5
50	2500	250
5	250	25

(top headers: 50, 5, 8)

9)

72x86   = (70x80)+(80x2)+(70x6)+(2x6)
           = 5600+160+420+12
           = 6192

	70	2
80	5600	160
6	420	12

10)

97x79   =(90x70)+(70x7)+(90x9)+(9x7)
           = 6300+490+810+63
           = 7663

	90	7
70	6300	490
9	810	63

Exercise 6: Working with decimals

1)

8.6 x 16   = (8x10)+(8x6)+(10X0.6)+(6x0.6)
            = 80+48+6+3.6
            = 137.6

	8	0.6
10	80	6
6	48	3.6

2)

3.4 x 34 = (3x30)+(3x4)+(30x0.4)+(4x0.4)
            = 90+12+ 12 + 1.6
            = 115.6

	3	0.4
30	90	12
4	12	1.6

3)

$1.2 \times 21 = (1\times20)+(1\times1)+(20\times0.2)+(0.2\times1)$
$\qquad = 20 + 1 + 4 + 0.2$
$\qquad = 25.2$

	1	0.2
20	20	4
1	1	0.2

4)

$7.9 \times 86 = (7\times80)+(7\times6)+(80\times0.9)+(0.9\times6)$
$\qquad = 560 + 42 + 72 + 5.4$
$\qquad = 679.4$

	7	0.9
80	560	72
6	42	5.4

5)

$6.4 \times 63 = (6\times60)+(6\times3)+(0.4\times60)+(0.4\times3)$
$\qquad = 360 + 18 + 24 + 1.2$
$\qquad = 403.2$

	6	0.4
60	360	24
3	18	1.2

6)

$57 \times 1.8 = (1\times50) + (0.8\times50)+(7\times0.8)+(1\times7)$
$\qquad = 50 + 40 + 5.6 + 7$
$\qquad = 102.6$

	1	0.8
50	50	40
7	7	5.6

7)

$61 \times 3.9 = (60\times3)+(60\times0.9)+(3\times1)+(0.9\times1)$
$\qquad = 180 + 54 + 3 + 0.9$
$\qquad = 237.9$

	3	0.9
60	180	54
1	3	0.9

8)

17 x 6.4 = (6x10)+(6x7)+(10x0.4)+(0.4x7)
= 60+42+4+2.8
= 108.8

	6	0.4
10	60	4
7	42	2.8

9)

92 x 7.8 = (7x90)+(7x2)+(0.8x90)+(0.8x2)
= 630+ 14 + 7.2 + 1.6
= 717.6

	7	0.8
90	630	72
2	14	1.6

10)

66 x 6.6 = (6x60)+(6x6)+(0.6x60)+(0.6x6)
= 360 + 36 + 36 + 3.6
= 435.6

	6	0.6
60	360	36
6	36	3.6

Exercise 7: Two Decimals

1)

3.4 x 5.7= (3x0.7)+(3x5)+(0.4x5)+(0.4x0.7)
= 2.1+ 2.0 + 15 + 0.28
= 19.38

	3	0.4
5	15	2.0
0.7	2.1	0.28

2)

4.6 x 8.1 = (4x8)+(4x0.1)+(0.6x8)+(0.6x0.1)
= 32 + 0.4 + 4.8 + 0.06
= 37.26

	4	0.6
8	32	4.8
0.1	0.4	0.06

3)

6.1 x 9.1 = (6x9)+(6x0.1)+(0.1x9)+(0.1x0.1)
   = 54 + 0.6 + 0.9 + 0.01
   = 55.51

	6	0.1
9	54	0.9
0.1	0.6	0.01

4)

5.2 x 3.4 = (5 x 3)+(5x0.4)+(0.2x3)+(0.2x0.4)
   = 15 + 0.6 + 0.08 + 2.0
   = 17.68

	5	0.2
3	15	0.6
0.4	2.0	0.08

5)

6.8 x 7.7 = (6x7)+(6x0.7)+(0.8x7)+(0.8 x 0.7)
   = 42 + 4.2 + 5.6 + 0.56
   = 52.36

	6	0.8
7	42	5.6
0.7	4.2	0.56

6)

9.2 x 1.9 = (9x1)+(9x0.9)+(0.2x1)+(0.2x0.9)
   = 9 + 8.1+ 0.2 + 1.8
   = 17.48

	9	0.2
1	9	0.2
0.9	8.1	0.18

7)

4.7 x 3.9 = (4x3)+(4x0.9)+(0.7x3)+(0.7x0.9)
   = 12 + 3.6 + 2.1 + 0.63
   = 18.33

	4	0.7
3	12	2.1
0.9	3.6	0.63

8)

$8.8 \times 9.7 = (8 \times 9) + (0.8 \times 9) + (8 \times 0.7) + (0.8 \times 0.7)$

$\qquad = 72 + 7.2 + 5.6 + 0.56$

$\qquad = 85.36$

	8	0.8
9	72	7.2
0.7	5.6	0.56

9)

$9.0 \times 8.6 = (9 \times 8) + (9 \times 0.6)$

$\qquad = 72 + 5.4$

$\qquad = 77.4$

	9	0.0
8	72	0.0
0.6	5.4	0.0

10)

$12.3 \times 3.3 = (12 \times 3) + (12 \times 0.3) + (0.3 \times 3) + (0.3 \times 0.3)$

$\qquad = 36 + 3.6 + 0.9 + 0.09$

$\qquad = 40.59$

	12	0.3
3	36	0.9
0.3	3.6	0.09

Exercise 8: The unknown Zone

1) △ =0.2   □ = 2.4   8.2 x 7.3 = 59.86
2) △ =0.2   □ = 48   8.2 x 6.4 = 52.48
3) △ =0.1   □ = 24   6.3 x 4.1 = 25.83
4) △ =2   □ =0.3   1.8 x 2.3 = 4.41
5) △ =0.5   □ = 42   6.7 x 7.5 = 50.25
6) △ =0.4   □ =27   9.4 x 3.6 = 33.84
7) △ =6   □ = 0.15   6.5 x 6.3 = 40.95
8) △ =9   □ =0.28   9.7 x 8.4 = 81.48
9) △ =0.54   □ = 21   7.6 x 3.9 = 29.64

Exercise 9: Word problems

1) 24 x 13= (20x10)+(20x3)+(4x10)+(4x3)

         = 200 + 60 + 40 + 12

         = 312m

	20	4
10	200	40
3	60	12

2) 17 x 12= (10x10)+(10x2)+(10x7)+(7x2)

         = 100 + 20 + 70 + 14

         = 204m

	10	7
10	100	70
2	20	14

3) 87 x 13 = (80x10)+(80x3)+(7x10)+(7x3)

         = 800 + 240 +70 + 21

         = $1131

	80	7
10	800	70
3	240	21

4) 2.30 x 6.00 = (2x6)+(0.3x6)

         = 12 + 1.8

         = $13.8

	2	0.3
6	12	1.8

5) 3.2 x 18 = (3x10) + (10x0.2)+ (8x3)+(8x0.2)

         = 30 + 2.0 + 24 + 1.6

         = 57.6 kg

	3	0.2
10	30	2.0
8	24	1.6

6)   18 x 23 = (10x20)+(10x3)+(8x20)+(8x3)
                 = 200 + 30 + 160 + 24
                 = 414 tins

	10	8
20	200	160
3	30	24

7)   1.6 x 3.5 = (1x3)+(1x0.5)+(0.6x0.5)+(0.6x3)
                   = 3 + 0.5 + 0.3+ 1.8
                   = 5.6sq m

	1	0.6
3	3	1.8
0.5	0.5	0.30

8)   36 x 28 = (30x20)+(8x30)+(6x20)+(6x8)
                 = 600 + 240 + 120 + 48
                 = 1008 sit ups

	30	6
20	600	120
8	240	48

9)   49 x 16 = (40x10)+(40x6)+(9x10)+(9x6)
                 = 400 + 240 + 90 + 54
                 = 784

	40	9
10	400	90
6	240	54

10)   1.3 x 7.8 = (1x7)+(1x0.8)+(0.3x7)+().3x0.8)
                   = 7 + 0.8 + 2.1 + 0.24
                   = 10.14

	1	0.3
7	7	2.1
0.8	0.8	0.24

Exercise 10: Investigation

Be prepared to present the answers to your investigation to the rest of the group, explaining what you tried and what you learned

Exercise 11: Moving to Algebra

1) $x^2 + 6x + 8$
2) $x^2 + 9x + 20$
3) $x^2 + 11x + 18$
4) $x^2 + 10x + 24$
5) $x^2 + 10x + 24$
6) $x^2 + 13x + 42$
7) $x^2 + 8x + 15$
8) $x^2 + 7x + 6$
9) $x^2 + 8x + 16$
10) $x^2 + 15x + 56$