

Whole Numbers

Solutions



Curriculum Ready



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First edition printed 2009 in Australia.

A catalogue record for this book is available from 3P Learning Ltd.

ISBN 978-1-921861-53-6

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Page 4 questions

Place values

1 Write down the place values for each of these numbers**a** 1426Place value of 1: **1000**Place value of 2: **20****b** 42 603Place value of 3: **3**Place value of 4: **40 000****c** 560 142Place value of 5: **500 000**Place value of 6: **60 000****d** 7 380 261Place value of 7: **7 000 000**Place value of 8: **80 000****2** Write each of these ordinary numbers in:

- (i) worded form
- (ii) expanded form

a 2560

(i) Two thousand, five hundred and sixty

(ii) $(2 \times 1000) + (5 \times 100) + (6 \times 10)$ **b** 1 306 211

(i) One million, three hundred and six thousand, two hundred and eleven

(ii) $(1 \times 1\,000\,000) + (3 \times 100\,000) + (0 \times 10\,000) + (6 \times 1000) + (2 \times 100) + (1 \times 10) + (1 \times 1)$ **c** 891 026

(i) Eight hundred and ninety one thousand, and twenty six

(ii) $(8 \times 100\,000) + (9 \times 10\,000) + (1 \times 1000) + (0 \times 100) + (2 \times 10) + (6 \times 1)$

Page 5 questions

Place values

d 708 002

(i) Seven hundred and eight thousand, and two

(ii) $(7 \times 100\,000) + (0 \times 10\,000) + (8 \times 1000) + (0 \times 100) + (0 \times 10) + (2 \times 1)$

e 9 011 060

(i) Nine million, eleven thousand, and sixty

(ii) $(9 \times 1\,000\,000) + (0 \times 100\,000) + (1 \times 10\,000) + (1 \times 1000) + (0 \times 100) + (6 \times 10) + (0 \times 1)$

3 Write the ordinary number for each of these:

a Four hundred and thirty nine thousand, two hundred and six

439 206

b $(4 \times 1\,000\,000) + (2 \times 100\,000) + (0 \times 10\,000) + (1 \times 1000) + (0 \times 100) + (3 \times 10) + (0 \times 1)$

4 201 030

c Eighty one thousand and five

81 005

d $(9 \times 10\,000) + (8 \times 1000) + (9 \times 100) + (9 \times 10) + (8 \times 1)$

98 998

e Any number whose place values for 4 , 5 and 2 are 4000, 5 and 200

Any number with the correct place values for 2, 4 and 5 such as:

14 235 , 4205 , 634 295 , 1 004 205

f Three million, thirty thousand and thirty

3 030 030

Page 9 questions

Adding and subtracting large numbers

1 Calculate each of these addition questions showing all working.

$$\begin{array}{r} \text{a} \quad 5 \ 6 \ 2 \ 1 \ 0 \ + \\ \quad \quad 8 \ 8 \ 3 \ 5 \\ \quad \underline{3 \ 0 \ 6 \ 1 \ 4} \\ 9 \ 5 \ 6 \ 5 \ 9 \end{array}$$

$$\begin{array}{r} \text{b} \quad 7 \ 1 \ 4 \ 0 \ 0 \ + \\ \quad \quad 1 \ 0 \ 8 \ 0 \ 9 \\ \quad \quad \quad \underline{4 \ 2 \ 0 \ 1} \\ 8 \ 6 \ 4 \ 1 \ 0 \end{array}$$

$$\begin{array}{r} \text{c} \quad \quad \quad 9 \ 9 \ + \\ \quad \quad 4 \ 3 \ 2 \ 1 \\ \quad \quad \underline{8 \ 6 \ 4 \ 2} \\ 1 \ 3 \ 0 \ 6 \ 2 \end{array}$$

$$\begin{array}{r} \text{d} \quad \quad \quad 8 \ 4 \ 3 \ + \\ \quad \quad \quad 1 \ 9 \ 5 \\ \quad \quad \quad 6 \ 0 \ 4 \\ \quad \quad \quad \quad \underline{2 \ 6 \ 3} \\ 1 \ 7 \ 0 \ 5 \end{array}$$

$$\begin{array}{r} \text{e} \quad 2 \ 4 \ 6 \ 3 \ 9 \ 9 \ + \\ \quad \quad 3 \ 9 \ 5 \ 1 \ 1 \\ \quad \quad \quad 7 \ 2 \ 6 \ 0 \\ \quad \quad \quad \quad \underline{2 \ 1 \ 9 \ 3} \\ 2 \ 9 \ 3 \ 3 \ 6 \ 3 \end{array}$$

$$\begin{array}{r} \text{f} \quad 8 \ 7 \ 6 \ 3 \ 8 \ + \\ \quad \quad \quad 2 \ 1 \\ \quad \quad 9 \ 3 \ 1 \ 0 \ 5 \\ \quad \quad \quad \quad \underline{1 \ 3 \ 4 \ 1 \ 2} \\ 1 \ 8 \ 4 \ 1 \ 7 \ 6 \end{array}$$

2 Combo Time!

$$\begin{array}{r} 3 \ 4 \ 5 \ 2 \ 0 \ 9 \ + \\ \quad \quad 1 \ 8 \ 7 \ 9 \ 6 \\ \quad \quad \quad \underline{1 \ 8 \ 7 \ 9 \ 6} \\ 3 \ 6 \ 4 \ 0 \ 0 \ 5 \end{array}$$

Page 10 questions

Adding and subtracting large numbers

$$\begin{array}{r} \text{3} \quad \text{a} \quad 5 \ 2 \ 6 \ 8 \ - \\ \quad \quad \quad \underline{2 \ 3 \ 5 \ 2} \\ 2 \ 9 \ 1 \ 6 \end{array}$$

$$\begin{array}{r} \text{b} \quad 2 \ 5 \ 2 \ 7 \ 2 \ - \\ \quad \quad \quad \underline{5 \ 6 \ 4 \ 0} \\ 1 \ 9 \ 6 \ 3 \ 2 \end{array}$$

Page 10 questions

Adding and subtracting large numbers

$$\begin{array}{r} \text{c} \quad 3 \ 6 \ 5 \ 2 \ 6 \ 8 \ - \\ \quad \quad 1 \ 0 \ 4 \ 8 \ 2 \\ \hline 3 \ 5 \ 4 \ 7 \ 8 \ 6 \end{array}$$

$$\begin{array}{r} \text{d} \quad 5 \ 4 \ 3 \ 2 \ 1 \ - \\ \quad \quad 1 \ 2 \ 3 \ 4 \ 5 \\ \hline 4 \ 1 \ 9 \ 7 \ 6 \end{array}$$

$$\begin{array}{r} \text{e} \quad 2 \ 0 \ 3 \ 0 \ 4 \ 0 \ - \\ \quad \quad 1 \ 0 \ 2 \ 0 \ 3 \\ \hline 1 \ 9 \ 2 \ 8 \ 3 \ 7 \end{array}$$

$$\begin{array}{r} \text{f} \quad 7 \ 0 \ 0 \ 0 \ 0 \ - \\ \quad \quad 2 \ 6 \ 7 \ 8 \ 9 \\ \hline 4 \ 3 \ 2 \ 1 \ 1 \end{array}$$

$$\begin{array}{r} \text{4} \quad 5 \ 7 \ 0 \ 2 \ 1 \ 7 \ - \\ \quad \quad 9 \ 8 \ 4 \ 2 \ 1 \\ \hline 4 \ 7 \ 1 \ 7 \ 9 \ 6 \end{array}$$

Page 12 questions

Long multiplication

$$\begin{array}{r} \text{1} \quad \text{a} \quad 3 \ 0 \ 1 \ 6 \times \\ \quad \quad \quad 2 \ 1 \\ \hline 3 \ 0 \ 1 \ 6 \\ 6 \ 0 \ 2 \ 2 \ 0 \\ \hline 6 \ 3 \ 3 \ 3 \ 6 \end{array}$$

Multiply 3016 by 1

Put a 0 in the ones column and multiply 3016 by 2

Add the columns together

$$\begin{array}{r} \text{b} \quad 2 \ 5 \ 8 \ 1 \times \\ \quad \quad \quad 1 \ 9 \\ \hline 1 \ 8 \ 5 \ 2 \ 9 \\ 2 \ 5 \ 8 \ 1 \ 0 \\ \hline 4 \ 9 \ 0 \ 3 \ 9 \end{array}$$

Multiply 2581 by 9

Put a 0 in the ones column and multiply 2581 by 1

Add the columns together

Page 12 questions

Long multiplication

$$\begin{array}{r} \text{c} \quad 9 \ 5 \ 7 \ 0 \times \\ \quad \quad \quad 6 \ 3 \\ \hline 2 \ 7 \ 5 \ 1 \ 0 \\ 5 \ 4 \ 0 \ 2 \ 0 \ 0 \\ \hline 6 \ 0 \ 2 \ 9 \ 1 \ 0 \end{array}$$

Multiply 9570 by 3

Put a 0 in the ones column and multiply 9570 by 6

Add the columns together

$$\begin{array}{r} \text{d} \quad 3 \ 8 \ 7 \ 6 \times \\ \quad \quad \quad 4 \ 5 \\ \hline 1 \ 5 \ 0 \ 5 \ 0 \\ 1 \ 2 \ 2 \ 8 \ 4 \ 0 \\ \hline 1 \ 7 \ 4 \ 4 \ 2 \ 0 \end{array}$$

Multiply 3876 by 5

Put a 0 in the ones column and multiply 3876 by 4

Add the columns together

$$\begin{array}{r} \text{e} \quad 1 \ 0 \ 1 \ 2 \times \\ \quad \quad \quad 3 \ 7 \\ \hline 7 \ 0 \ 7 \ 4 \\ 3 \ 0 \ 3 \ 6 \ 0 \\ \hline 3 \ 7 \ 4 \ 4 \ 4 \end{array}$$

Multiply 1012 by 7

Put a 0 in the ones column and multiply 1012 by 3

Add the columns together

$$\begin{array}{r} \text{f} \quad 2 \ 0 \ 2 \ 0 \ 2 \times \\ \quad \quad \quad 1 \ 5 \\ \hline 1 \ 0 \ 0 \ 0 \ 0 \\ 2 \ 0 \ 2 \ 0 \ 2 \ 0 \\ \hline 3 \ 0 \ 3 \ 0 \ 3 \ 0 \end{array}$$

Multiply 20202 by 5

Put a 0 in the ones column and multiply 20202 by 1

Add the columns together

Page 13 questions

Long multiplication

$$\begin{array}{r} \text{1} \quad \text{a} \quad 2 \ 1 \ 2 \times \\ \quad \quad \quad 1 \ 2 \ 1 \\ \hline 2 \ 1 \ 2 \\ 4 \ 2 \ 4 \ 0 \\ 2 \ 1 \ 2 \ 0 \ 0 \\ \hline 2 \ 5 \ 6 \ 5 \ 2 \end{array}$$

Multiply 212 by 1

Put a 0 in the ones column and multiply 212 by 2

Put 0s in the ones and tens columns and multiply 212 by 1

Add the columns together

Page 13 questions

Long multiplication

$$\begin{array}{r}
 \text{b} \quad \quad \quad 258 \times \\
 \quad \quad \quad \underline{405} \\
 \quad \quad \quad 1050 \\
 \quad \quad \quad 0000 \\
 \quad \quad \quad \underline{+1800} \\
 \quad \quad \quad 104490
 \end{array}$$

Multiply 258 by 5

Put a 0 in the ones column and multiply 258 by 0

Put 0s in the ones and tens columns and multiply 258 by 4

Add the columns together

$$\begin{array}{r}
 \text{c} \quad \quad \quad 908 \times \\
 \quad \quad \quad \underline{209} \\
 \quad \quad \quad 8102 \\
 \quad \quad \quad 0000 \\
 \quad \quad \quad \underline{+1800} \\
 \quad \quad \quad 189772
 \end{array}$$

Multiply 908 by 9

Put a 0 in the ones column and multiply 908 by 0

Put 0s in the ones and tens columns and multiply 908 by 2

Add the columns together

$$\begin{array}{r}
 \text{d} \quad \quad \quad 864 \times \\
 \quad \quad \quad \underline{345} \\
 \quad \quad \quad 4000 \\
 \quad \quad \quad 3240 \\
 \quad \quad \quad \underline{+2400} \\
 \quad \quad \quad 298080
 \end{array}$$

Multiply 864 by 5

Put a 0 in the ones column and multiply 864 by 4

Put 0s in the ones and tens columns and multiply 864 by 3

Add the columns together

$$\begin{array}{r}
 \text{e} \quad \quad \quad 1325 \times \\
 \quad \quad \quad \underline{437} \\
 \quad \quad \quad 7145 \\
 \quad \quad \quad 39650 \\
 \quad \quad \quad \underline{+42800} \\
 \quad \quad \quad 579025
 \end{array}$$

Multiply 1325 by 7

Put a 0 in the ones column and multiply 1325 by 3

Put 0s in the ones and tens columns and multiply 1325 by 4

Add the columns together

$$\begin{array}{r}
 \text{f} \quad \quad \quad 6485 \times \\
 \quad \quad \quad \underline{123} \\
 \quad \quad \quad 18245 \\
 \quad \quad \quad 128600 \\
 \quad \quad \quad \underline{+64800} \\
 \quad \quad \quad 797655
 \end{array}$$

Multiply 6485 by 3

Put a 0 in the ones column and multiply 6485 by 2

Put 0s in the ones and tens columns and multiply 6485 by 1

Add the columns together

Page 16 questions

Short division

1 a $4767 \div 3 = 1589$

$$\begin{array}{r} 1\ 5\ 8\ 9 \\ 3 \overline{) 4\ 7\ 6\ 7} \end{array}$$

b $6180 \div 5 = 1236$

$$\begin{array}{r} 1\ 2\ 3\ 6 \\ 5 \overline{) 6\ 1\ 8\ 0} \end{array}$$

c $6912 \div 4 = 1728$

$$\begin{array}{r} 1\ 7\ 2\ 8 \\ 4 \overline{) 6\ 9\ 1\ 2} \end{array}$$

d $12\ 054 \div 6 = 2009$

$$\begin{array}{r} 0\ 2\ 0\ 0\ 9 \\ 6 \overline{) 1\ 2\ 0\ 5\ 4} \end{array}$$

2 a $8965 \div 7 = 1280\frac{5}{7}$

$$\begin{array}{r} 1\ 2\ 8\ 0\ r\frac{5}{7} \\ 7 \overline{) 8\ 9\ 6\ 5} \end{array}$$

b $3879 \div 2 = 1939\frac{1}{2}$

$$\begin{array}{r} 1\ 9\ 3\ 9\ r\frac{1}{2} \\ 2 \overline{) 3\ 8\ 7\ 9} \end{array}$$

c $9263 \div 8 = 1175\frac{7}{8}$

$$\begin{array}{r} 1\ 1\ 5\ 7\ r\frac{7}{8} \\ 8 \overline{) 9\ 2\ 6\ 3} \end{array}$$

d $5801 \div 6 = 966\frac{5}{6}$

$$\begin{array}{r} 0\ 9\ 6\ 6\ r\frac{5}{6} \\ 6 \overline{) 5\ 8\ 0\ 1} \end{array}$$

Page 17 questions

Long division

$$\begin{array}{r} \textcircled{1} \quad \textcircled{a} \quad \begin{array}{r} 2 \ 5 \ 7 \\ 15 \overline{) 3 \ 8 \ 5 \ 5} \\ \underline{3 \ 0} \quad \downarrow \quad \downarrow \\ 8 \ 5 \\ \underline{7 \ 5} \quad \downarrow \\ 1 \ 0 \ 5 \\ \underline{1 \ 0 \ 5} \\ 0 \end{array} \end{array}$$

$$\therefore 3855 \div 15 = 257$$

$$\begin{array}{r} \textcircled{b} \quad \begin{array}{r} 3 \ 8 \ 9 \\ 23 \overline{) 8 \ 9 \ 4 \ 7} \\ \underline{6 \ 9} \quad \downarrow \quad \downarrow \\ 2 \ 0 \ 4 \\ \underline{1 \ 8 \ 4} \quad \downarrow \\ 2 \ 0 \ 7 \\ \underline{2 \ 0 \ 7} \\ 0 \end{array} \end{array}$$

$$\therefore 8947 \div 23 = 389$$

$$\begin{array}{r} \textcircled{c} \quad \begin{array}{r} 2 \ 1 \ 6 \ \frac{1}{24} \\ 24 \overline{) 5 \ 1 \ 8 \ 5} \\ \underline{4 \ 8} \quad \downarrow \quad \downarrow \\ 3 \ 8 \\ \underline{2 \ 4} \quad \downarrow \\ 1 \ 4 \ 5 \\ \underline{1 \ 4 \ 4} \\ 1 \end{array} \end{array}$$

$$\therefore 5185 \div 24 = 216\frac{1}{24}$$

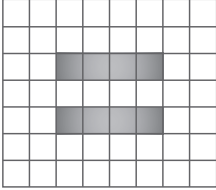
$$\begin{array}{r} \textcircled{d} \quad \begin{array}{r} 1 \ 5 \ 1 \ \frac{11}{17} \\ 17 \overline{) 2 \ 5 \ 7 \ 8} \\ \underline{1 \ 7} \quad \downarrow \quad \downarrow \\ 8 \ 7 \\ \underline{8 \ 5} \quad \downarrow \\ 2 \ 8 \\ \underline{1 \ 7} \\ 1 \ 1 \end{array} \end{array}$$

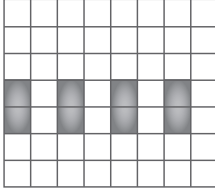
$$\therefore 2578 \div 17 = 151\frac{11}{17}$$

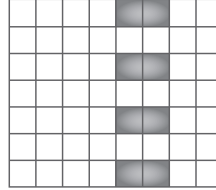
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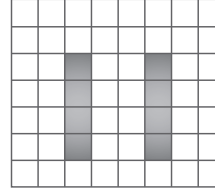
Commutative laws

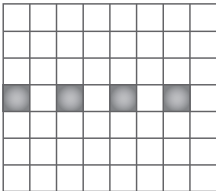
1

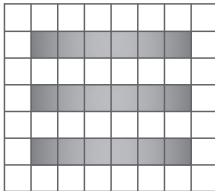
a Two rows of four

 = 2×4

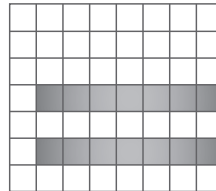
b Four columns of two

 = 4×2

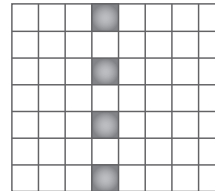
c Four rows of two

 = 4×2

d Two columns of four

 = 2×4


e Four columns of one

 = 4×1


f Three rows of six

 = 3×6

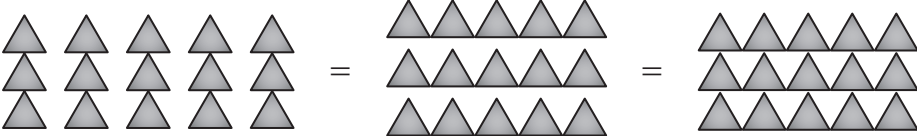
g Two rows of seven

 = 2×7

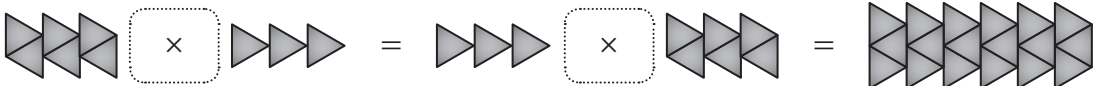
h Four rows of one

 = 4×1

2

a

 $3 + 2 = 2 + 3 = 5$

b

 $2 \times 3 = 3 \times 2 = 6$

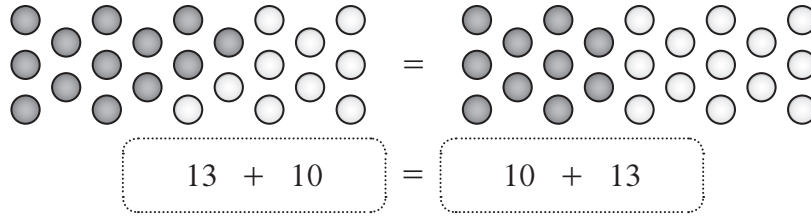
c

 $5 \times 3 = 3 \times 5 = 15$

d

 $6 \times 3 = 3 \times 6 = 18$

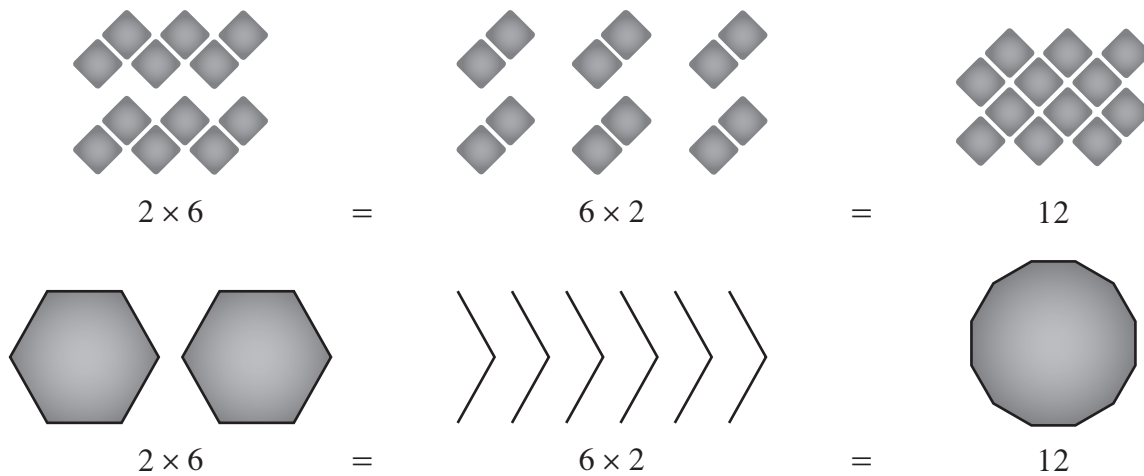
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Commutative laws

3

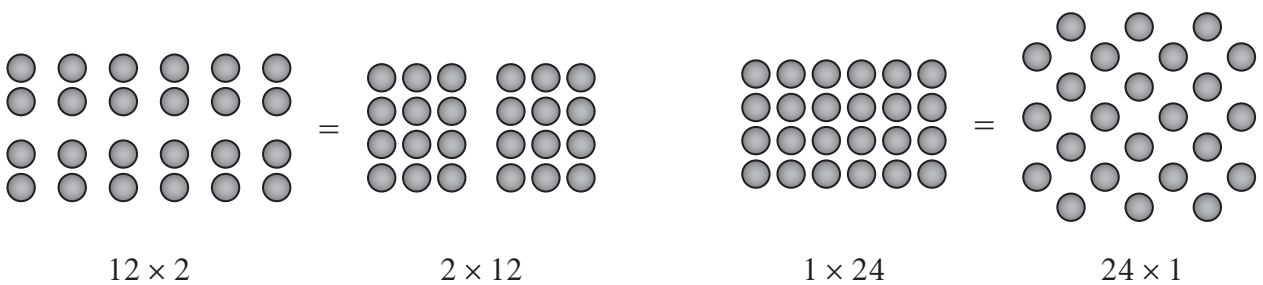
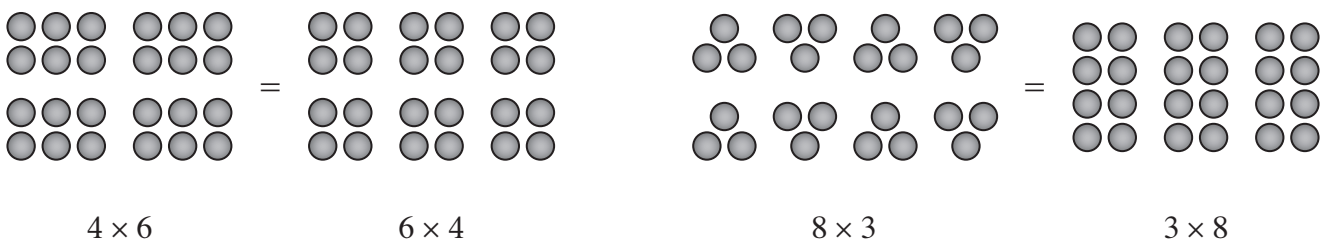


4 Here are two of the many possibilities



5 To obtain an answer of 24, these whole number multiplications are possible:

- | | | | |
|--------------|--------------|---------------|---------------|
| 4×6 | 3×8 | 2×12 | 1×24 |
| 6×4 | 8×3 | 12×2 | 24×1 |



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Associative laws

1 a

$$\left\{ \begin{array}{c} \star \star \star \\ \star \star \star \end{array} \right\} + \begin{array}{c} \star \star \star \\ \star \star \star \end{array} = \left\{ \begin{array}{c} \star \star \star \\ \star \star \star \end{array} \right\} + \begin{array}{c} \star \star \star \\ \star \star \star \end{array} = 12$$

$$\left\{ \begin{array}{c} 2 \\ + \\ 4 \end{array} \right\} + \begin{array}{c} 6 \end{array} = \left\{ \begin{array}{c} 2 \\ + \\ 6 \end{array} \right\} + \begin{array}{c} 4 \end{array}$$

$$\begin{array}{c} 6 \\ + \\ 6 \end{array} = \begin{array}{c} 8 \\ + \\ 4 \end{array} = \begin{array}{c} 12 \end{array}$$

b

$$\begin{array}{c} \text{Hexagons} \\ 8 \end{array} + \left\{ \begin{array}{c} 3 \text{ dark} \\ 5 \text{ light} \end{array} \right\} = \left\{ \begin{array}{c} 3 \text{ dark} \end{array} \right\} + \begin{array}{c} \text{Hexagons} \\ 8 \text{ dark} \\ 5 \text{ light} \end{array}$$

$$\begin{array}{c} 8 \\ + \\ 8 \end{array} = \begin{array}{c} 3 \\ + \\ 13 \end{array} = \begin{array}{c} 16 \end{array}$$

c

$$\left\{ \begin{array}{c} 5 \text{ dark} \\ 5 \text{ light} \end{array} \right\} + \left\{ \begin{array}{c} 3 \text{ dark} \\ 5 \text{ light} \end{array} \right\} = \begin{array}{c} 5 \text{ dark} \\ 5 \text{ light} \end{array} + \left\{ \begin{array}{c} 10 \text{ dark} \\ 8 \text{ light} \end{array} \right\}$$

$$\left\{ \begin{array}{c} 5 \\ + \\ 10 \end{array} \right\} + \begin{array}{c} 8 \end{array} = \begin{array}{c} 5 \\ + \\ 18 \end{array} = \begin{array}{c} 23 \end{array}$$

d

$$\begin{array}{c} \text{Grid} \\ 24 \end{array} + \left\{ \begin{array}{c} 3 \times 5 \text{ grid} \\ 15 \end{array} \right\} = \left\{ \begin{array}{c} 7 \times 4 \text{ grid} \\ 28 \end{array} \right\} + \begin{array}{c} \text{Grid} \\ 15 \end{array}$$

$$\begin{array}{c} 24 \\ + \\ 15 \end{array} = \begin{array}{c} 28 \\ + \\ 15 \end{array} = \begin{array}{c} 44 \end{array}$$

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Associative laws

$$\begin{aligned} \text{2 a } 25 + 91 + 75 &= \{25 + 75\} + 91 \\ &= 100 + 91 \\ &= 191 \end{aligned}$$

$$\begin{aligned} \text{b } 83 + 52 + 18 &= \{52 + 18\} + 83 \\ &= 70 + 83 \\ &= 153 \end{aligned}$$

$$\begin{aligned} \text{c } 122 + 163 + 37 &= \{163 + 37\} + 122 \\ &= 200 + 122 \\ &= 322 \end{aligned}$$

$$\begin{aligned} \text{d } 102 + 43 + 25 &= \{102 + 43\} + 25 \\ &= 145 + 25 \\ &= 170 \end{aligned}$$

$$\begin{aligned} \text{e } 37 + 14 + 56 + 23 &= \{37 + 23\} + \{14 + 56\} \\ &= 60 + 70 \\ &= 130 \end{aligned}$$

$$\begin{aligned} \text{f } 111 + 80 + 19 + 45 &= \{111 + 19\} + \{80 + 45\} \\ &= 130 + 125 \\ &= 255 \end{aligned}$$

Page 24 questions

Associative laws

3 a

$$\begin{array}{|c|} \hline \square \\ \hline \square \\ \hline \end{array} \times \left\{ \begin{array}{|c|c|c|} \hline \square & \square & \square \\ \hline \end{array} \right\} = \left\{ \begin{array}{|c|c|} \hline \square & \square \\ \hline \square & \square \\ \hline \end{array} \right\} \times \begin{array}{|c|} \hline \square \\ \hline \end{array} = 6$$

$$\boxed{2} \times \left\{ \boxed{3} \times \boxed{1} \right\} = \left\{ \boxed{2} \times \boxed{3} \right\} \times \boxed{1}$$

$$\boxed{2} \times \boxed{3} = \boxed{6} \times \boxed{1} = 6$$

b

$$\left\{ \begin{array}{|c|c|c|} \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \end{array} \right\} \times \begin{array}{|c|c|c|} \hline \square & \square & \square \\ \hline \end{array} = \begin{array}{|c|c|} \hline \square & \square \\ \hline \end{array} \times \left\{ \begin{array}{|c|c|c|} \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \end{array} \right\} = 40$$

$$\left\{ \boxed{2} \times \boxed{4} \right\} \times \boxed{5} = \boxed{2} \times \left\{ \boxed{4} \times \boxed{5} \right\}$$

$$\boxed{8} \times \boxed{5} = \boxed{2} \times \boxed{20} = 40$$

c

$$\left\{ \begin{array}{|c|c|c|} \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \end{array} \right\} \times \begin{array}{|c|c|c|} \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \end{array} = \begin{array}{|c|c|} \hline \square & \square \\ \hline \square & \square \\ \hline \square & \square \\ \hline \square & \square \\ \hline \end{array} \times \left\{ \begin{array}{|c|c|c|} \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \square & \square & \square \\ \hline \end{array} \right\} = 168$$

$$\left\{ \boxed{8} \times \boxed{3} \right\} \times \boxed{7} = \boxed{8} \times \left\{ \boxed{3} \times \boxed{7} \right\}$$

$$\boxed{24} \times \boxed{7} = \boxed{8} \times \boxed{21} = 168$$

d

$$\begin{array}{|c|c|c|c|} \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \end{array} \times \left\{ \begin{array}{|c|c|c|c|} \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \end{array} \right\} = \left\{ \begin{array}{|c|c|c|c|} \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \end{array} \right\} \times \begin{array}{|c|c|c|c|} \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \square & \square & \square & \square \\ \hline \end{array}$$

$$\boxed{6} \times \left\{ \boxed{3} \times \boxed{10} \right\} = \left\{ \boxed{6} \times \boxed{3} \right\} \times \boxed{10}$$

$$\boxed{6} \times \boxed{30} = \boxed{18} \times \boxed{10} = \boxed{180}$$

Page 25 questions

Associative laws

4 a

$$2 \times (3 \times 3) = (2 \times 3) \times 3$$

b

$$4 \times (3 \times 6) = (4 \times 3) \times 6$$

c

$$4 \times (2 \times 3) = (4 \times 2) \times 3 = 24$$

d

$$3 \times (5 \times 2) = (3 \times 5) \times 2 = 30$$

5 a

$$5 \times 28 \times 20 = \{ 5 \times 20 \} \times 28$$

$$= 100 \times 28$$

$$= 2800$$

b

$$12 \times 50 \times 7 = \{ 12 \times 50 \} \times 7$$

$$= 600 \times 7$$

$$= 4200$$

c

$$4 \times 9 \times 75 = \{ 4 \times 75 \} \times 9$$

$$= 300 \times 9$$

$$= 2700$$

d

$$15 \times 12 \times 11 = \{ 15 \times 12 \} \times 11$$

$$= 180 \times 11$$

$$= 1980$$

Page 26 questions

Associative laws

- 6 a $(12 \div 4) \div 1 = 12 \div (4 \div 1)$ True False b $(5 \div 0) \div 3 = 5 \div (0 \div 3)$ True False
 c $(0 - 4) - 3 = 0 - (4 - 3)$ True False d $(0 \div 16) \div 2 = 0 \div (16 \div 2)$ True False
 e $(20 - 11) - 0 = 20 - (11 - 0)$ True False f $(5 \div 1) \div 5 = 5 \div (1 \div 5)$ True False
 g $(0 \div 1) \div 1 = 0 \div (1 \div 1)$ True False h $(8 - 0) - 1 = 8 - (0 - 1)$ True False
 i $(1 - 1) - 1 = 1 - (1 - 1)$ True False j $(0 - 1) - 0 = 0 - (1 - 0)$ True False

7 a $12 + 34 + 8 + 4 + 2$

$$(12 + 8) + (34 + 4 + 2) = 20 + 40 = 60$$

$$(2 + 8) + (34 + 4 + 12) = 10 + 50 = 60$$

Numbers were grouped that added to a multiple of 10 to make it easier to add together.

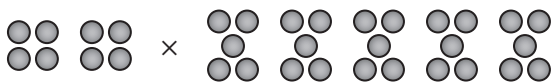
b $12 \times 2 \times 5 \times 3$

$$(12 \times 3) \times (2 \times 5) = 36 \times 10 = 360$$

$$(12 \times 5) \times (2 \times 3) = 60 \times 6 = 360$$

c $23 + 11 + 37 + 24 + 16 + 9$

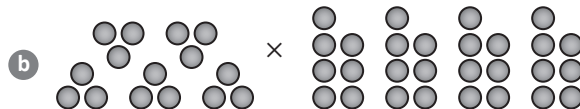
$$(23 + 37) + (24 + 16) + (11 + 9) = 60 + 40 + 20 = 120$$

8 a 

$$2 \times 4 \times 5 \times 5 = \{2 \times 5\} \times \{4 \times 5\}$$

$$= 10 \times 20$$

$$= 200$$

b 

$$5 \times 3 \times 4 \times 7 = \{5 \times 4\} \times \{3 \times 7\}$$

$$= 20 \times 21$$

$$= 420$$

Page 28 questions

Distributive law

$$1 \quad a \quad 3 \times \{5 + 6\} = 3 \times 5 + 3 \times 6$$

$$b \quad 7 \times \{8 - 4\} = 7 \times 8 - 7 \times 4$$

$$c \quad 6 \times 13 + 6 \times 9 = 6 \times \{13 + 9\}$$

$$d \quad 15 \times 7 - 15 \times 10 = 15 \times \{7 - 10\}$$

$$e \quad 5 \times \{9 + 11\} = 45 + 5 \times 11$$

$$f \quad 12 \times \{3 - 1\} = 36 - 12$$

$$2 \quad a \quad \alpha) \quad 5 \times \{8 + 2\} = 5 \times 8 + 5 \times 2 \\ = 40 + 10 \\ = 50$$

$$\beta) \quad 5 \times \{4 + 6\} = 5 \times 4 + 5 \times 6 \\ = 20 + 30 \\ = 50$$

- b) The sum of the terms inside both brackets are equal.
So 5 is multiplied by the same value in both expressions.

$$c \quad 5 \times \{0 + 10\} \quad 5 \times \{1 + 9\} \quad 5 \times \{3 + 7\} \quad 5 \times \{5 + 5\}$$

The sum of the terms inside the brackets must equal 10.

$$3 \quad a \quad 6 \times 25 = 6 \times \{20 + 5\} \\ = 6 \times 20 + 6 \times 5 \\ = 120 + 30 \\ = 150$$

$$b \quad 8 \times 98 = 8 \times \{100 - 2\} \\ = 8 \times 100 - 8 \times 2 \\ = 800 - 16 \\ = 784$$

$$c \quad 11 \times 32 = 11 \times \{30 + 2\} \\ = 11 \times 30 + 11 \times 2 \\ = 330 + 22 \\ = 352$$

$$d \quad 15 \times 19 = 15 \times \{20 - 1\} \\ = 15 \times 20 - 15 \times 1 \\ = 300 - 15 \\ = 285$$

Page 29 questions

Distributive law

4 a 14×37

$$\begin{aligned}
 14 \times 37 &= 14 \times (40 - 3) \\
 &= 14 \times 40 - 14 \times 3 \\
 &= 14 \times 40 - 42 \\
 &\quad \swarrow \quad \searrow \\
 &= (10 + 4) \times 40 - 42 \\
 &= 10 \times 40 + 4 \times 40 - 42 \\
 &= 400 + 160 - 42 \\
 &= 518
 \end{aligned}$$

b 45×82

$$\begin{aligned}
 45 \times 82 &= 45 \times (80 + 2) \\
 &= 45 \times 80 + 45 \times 2 \\
 &= 45 \times 80 + 90 \\
 &\quad \swarrow \quad \searrow \\
 &= (40 + 5) \times 80 + 90 \\
 &= 40 \times 80 + 5 \times 80 + 90 \\
 &= 3200 + 400 + 90 \\
 &= 3690
 \end{aligned}$$

c 22×75

$$\begin{aligned}
 22 \times 75 &= 75 \times (20 + 2) \\
 &= 75 \times 20 + 75 \times 2 \\
 &= 75 \times 20 + 150 \\
 &\quad \swarrow \quad \searrow \\
 &= (70 + 5) \times 20 + 150 \\
 &= 70 \times 20 + 5 \times 20 + 150 \\
 &= 1400 + 100 + 150 \\
 &= 1650
 \end{aligned}$$

d 25×112

$$\begin{aligned}
 25 \times 112 &= 25 \times (100 + 12) \\
 &= 25 \times 100 + 25 \times 12 \\
 &= 2500 + 25 \times 12 \\
 &\quad \swarrow \quad \searrow \\
 &= 2500 + (20 + 5) \times 12 \\
 &= 2500 + 20 \times 12 + 5 \times 12 \\
 &= 2500 + 240 + 60 \\
 &= 2800
 \end{aligned}$$

e 83×35

$$\begin{aligned}
 35 \times 83 &= 35 \times (80 + 3) \\
 &= 35 \times 80 + 35 \times 3 \\
 &= 35 \times 80 + 105 \\
 &\quad \swarrow \quad \searrow \\
 &= (30 + 5) \times 80 + 105 \\
 &= 30 \times 80 + 5 \times 80 + 105 \\
 &= 2400 + 400 + 105 \\
 &= 2905
 \end{aligned}$$

f 120×108

$$\begin{aligned}
 120 \times 108 &= 120 \times (110 - 2) \\
 &= 120 \times 110 - 120 \times 2 \\
 &= 120 \times 110 - 240 \\
 &\quad \swarrow \quad \searrow \\
 &= (100 + 20) \times 110 - 240 \\
 &= 100 \times 110 + 20 \times 110 - 240 \\
 &= 11000 + 2200 - 240 \\
 &= 12960
 \end{aligned}$$

Page 31 questions

Divisibility Tests

2, 4, 5, 10

2, 4, 8

2, 3, 4, 6, 8

3

3, 5

3, 9

2, 4, 8

2, 3, 4, 6

2, 3, 6, 9

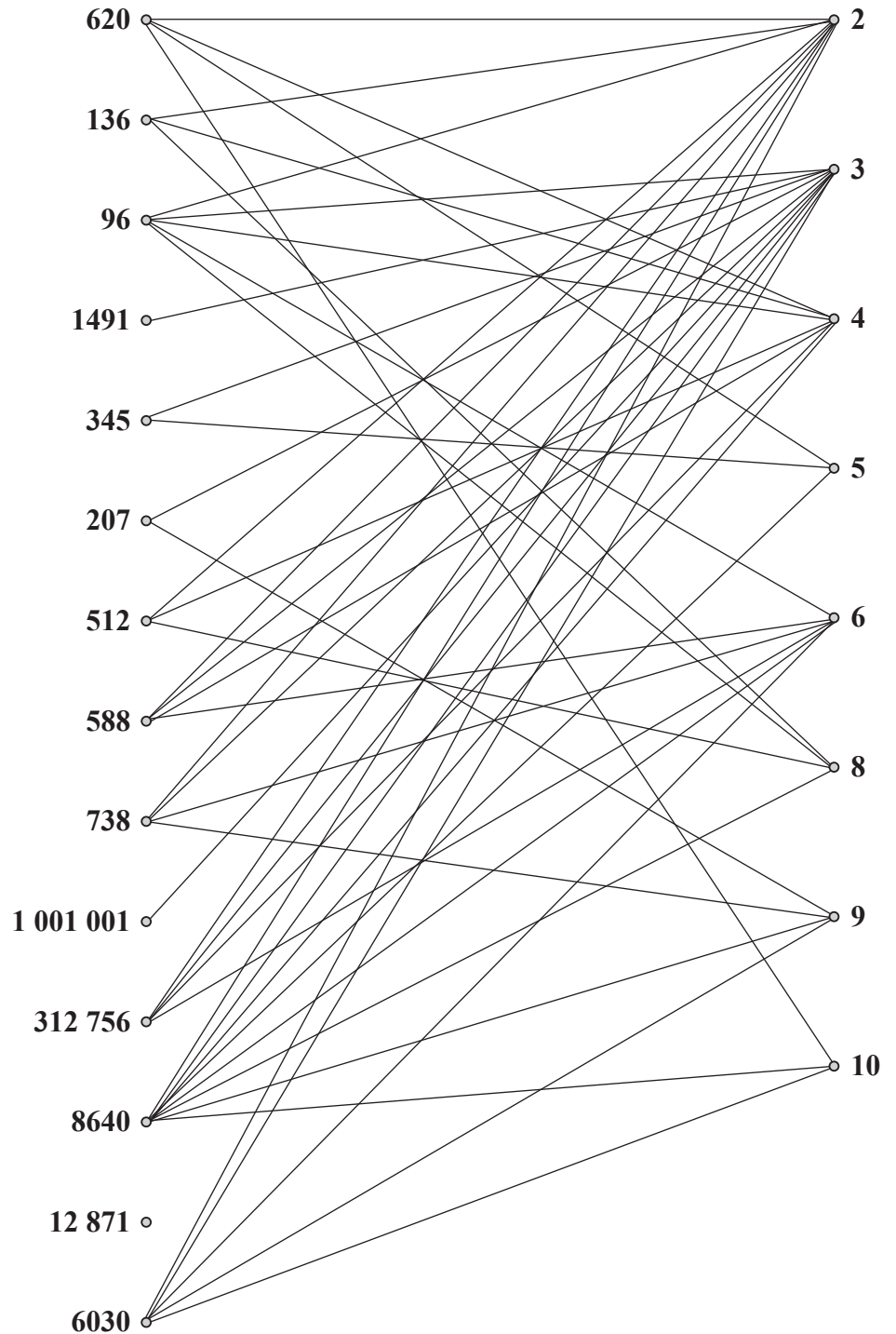
3

2, 3, 4, 6

2, 3, 4, 5, 6, 8, 9, 10

None of them

2, 3, 6, 9, 10



Page 33 questions

Index notation for numbers

1 a $5 \times 5 = 5^2$

b $4 \times 4 \times 4 = 4^3$

c $2 \times 2 \times 2 \times 2 \times 2 = 2^5$

d $11 \times 11 \times 11 \times 11 = 11^4$

e $7 \times 7 \times 7 \times 7 \times 7 \times 7 = 7^6$

f $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^8$

2 a $2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$
 $= 8 \times 6$
 $= 48$

b $5 \times 5 \times 4 \times 4 = 5^2 \times 4^2$
 $= 25 \times 16$
 $= 400$

c $6 \times 6 \times 6 \times 6 \times 7 \times 7 \times 7 = 6^4 \times 7^3$
 $= 1296 \times 343$
 $= 444528$

d $2 \times 1 \times 2 \times 1 \times 2 = 1^2 \times 2^3$
 $= 1 \times 8$
 $= 8$

e $2 \times 8 \times 8 \times 2 \times 8 \times 8 \times 8 = 2^2 \times 8^5$
 $= 4 \times 32768$
 $= 131072$

f $4 \times 3 \times 3 \times 4 \times 3 \times 2 \times 2 \times 2 = 2^3 \times 3^3 \times 4^2$
 $= 8 \times 27 \times 16$
 $= 3456$

3 a $3^3 = 3 \times 3 \times 3$

b $8^4 = 8 \times 8 \times 8 \times 8$

c $6^5 = 6 \times 6 \times 6 \times 6 \times 6$

d $12^7 = 12 \times 12 \times 12 \times 12 \times 12 \times 12 \times 12$

e $5^3 \times 7^2 = 5 \times 5 \times 5 \times 7 \times 7$

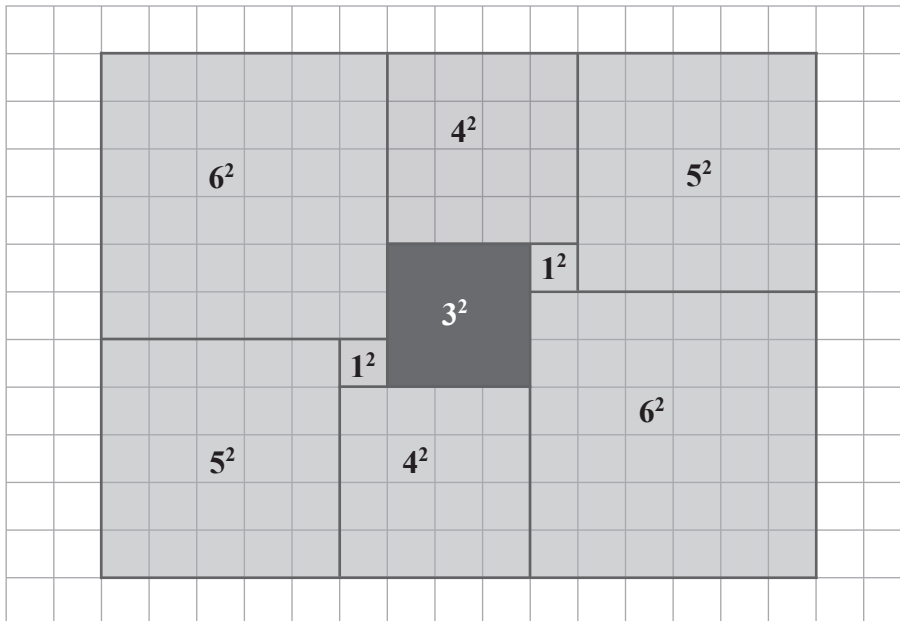
f $2^4 \times 3^2 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

g $7^5 \times 2^4 = 7 \times 7 \times 7 \times 7 \times 7 \times 2 \times 2 \times 2 \times 2$

h $2^2 \times 3^4 \times 5^2 = 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 5 \times 5$

Page 34 questions

Puzzle Time



Area expression 1

$$\text{Area} = 2 \times 1^2 + 3^2 + 2 \times 4^2 + 2 \times 5^2 + 2 \times 6^2$$

Area expression 2

$$\text{Area} = (5 + 6) \times (4 + 5 + 6)$$

If you went further and calculated the area, you would get:

$$= 2 + 9 + 32 + 50 + 72 \text{ units}^2$$

$$= 165 \text{ units}^2$$

$$= 11 \times 15 \text{ units}^2$$

$$= 165 \text{ units}^2$$

Page 24 questions

Square roots and cube roots

 \therefore means 'because'

$$\begin{aligned} \text{1 a } \sqrt{4} &= 2 & \text{or } \sqrt{4} &= \sqrt{2 \times 2} \\ & \because 2 \times 2 &= 4 &= \sqrt{2^2} \\ & & &= 2 \end{aligned}$$

$$\begin{aligned} \text{b } \sqrt{16} &= 4 & \text{or } \sqrt{16} &= \sqrt{4 \times 4} \\ & \because 4 \times 4 &= 16 &= \sqrt{4^2} \\ & & &= 4 \end{aligned}$$

$$\begin{aligned} \text{c } \sqrt{25} &= 5 & \text{or } \sqrt{25} &= \sqrt{5 \times 5} \\ & \because 5 \times 5 &= 25 &= \sqrt{5^2} \\ & & &= 5 \end{aligned}$$

$$\begin{aligned} \text{d } \sqrt{49} & & \text{or } \sqrt{49} &= \sqrt{7 \times 7} \\ & \because 7 \times 7 &= 49 &= \sqrt{7^2} \\ & & &= 7 \end{aligned}$$

Page 36 questions

Square roots and cube roots

 \therefore means 'because'

$$\begin{array}{l} \text{e } \sqrt{81} = 9 \\ \therefore 9 \times 9 = 81 \end{array} \quad \text{or} \quad \begin{array}{l} \sqrt{81} = \sqrt{9 \times 9} \\ = \sqrt{9^2} \\ = 9 \end{array} \quad \text{f } \sqrt{121} = 11 \quad \text{or} \quad \begin{array}{l} \sqrt{121} = \sqrt{11 \times 11} \\ = \sqrt{11^2} \\ = 11 \end{array}$$

$$\text{2 a } \sqrt[3]{27} = 3 \quad \text{or} \quad \begin{array}{l} \sqrt[3]{27} = \sqrt[3]{3 \times 3 \times 3} \\ = \sqrt[3]{3^3} \\ = 3 \end{array} \quad \text{b } \sqrt[3]{64} = 4 \quad \text{or} \quad \begin{array}{l} \sqrt[3]{64} = \sqrt[3]{4 \times 4 \times 4} \\ \therefore 4 \times 4 \times 4 = 64 \\ = 4 \end{array}$$

$$\text{c } \sqrt[3]{216} = 6 \quad \text{or} \quad \begin{array}{l} \sqrt[3]{216} = \sqrt[3]{6 \times 6 \times 6} \\ = \sqrt[3]{6^3} \\ = 6 \end{array} \quad \text{d } \sqrt[3]{512} = 8 \quad \text{or} \quad \begin{array}{l} \sqrt[3]{512} = \sqrt[3]{8 \times 8 \times 8} \\ = \sqrt[3]{8^3} \\ = 8 \end{array}$$

$$\text{3 a } 3 = \sqrt{9} \quad \text{or} \quad \begin{array}{l} 3^2 = 3 \times 3 \\ = 9 \\ \therefore 3 = \sqrt{9} \end{array} \quad \text{b } 8 = \sqrt{64} \quad \text{or} \quad \begin{array}{l} 8^2 = 8 \times 8 \\ \therefore 8 \times 8 = 64 \\ \therefore 8 = \sqrt{64} \end{array}$$

$$\text{c } 6 = \sqrt{36} \quad \text{or} \quad \begin{array}{l} 6^2 = 6 \times 6 \\ = 36 \\ \therefore 6 = \sqrt{36} \end{array} \quad \text{d } 12 = \sqrt{144} \quad \text{or} \quad \begin{array}{l} 12^2 = 12 \times 12 \\ = 144 \\ \therefore 12 = \sqrt{144} \end{array}$$

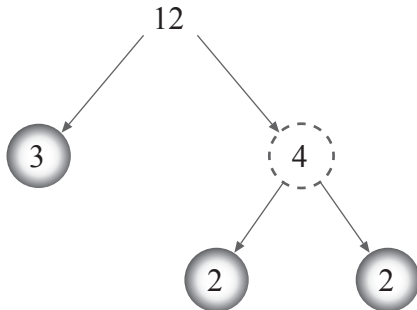
$$\text{4 a } 1 = \sqrt[3]{1} \quad \text{or} \quad \begin{array}{l} 1^3 = 1 \times 1 \times 1 \\ = 1 \\ \therefore 1 = \sqrt[3]{1} \end{array} \quad \text{b } 2 = \sqrt[3]{8} \quad \text{or} \quad \begin{array}{l} 2^3 = 2 \times 2 \times 2 \\ \therefore 2 \times 2 \times 2 = 8 \\ \therefore 2 = \sqrt[3]{8} \end{array}$$

$$\text{c } 5 = \sqrt[3]{125} \quad \text{or} \quad \begin{array}{l} 5^3 = 5 \times 5 \times 5 \\ = 125 \\ \therefore 5 = \sqrt[3]{125} \end{array} \quad \text{d } 7 = \sqrt[3]{343} \quad \text{or} \quad \begin{array}{l} 7^3 = 7 \times 7 \times 7 \\ = 343 \\ \therefore 7 = \sqrt[3]{343} \end{array}$$

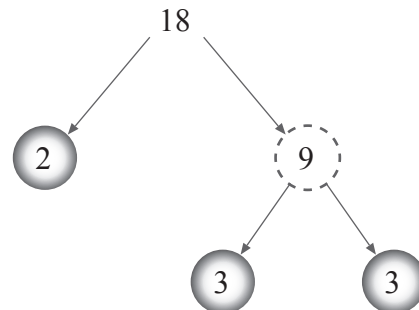
Page 39 questions

Factor Trees

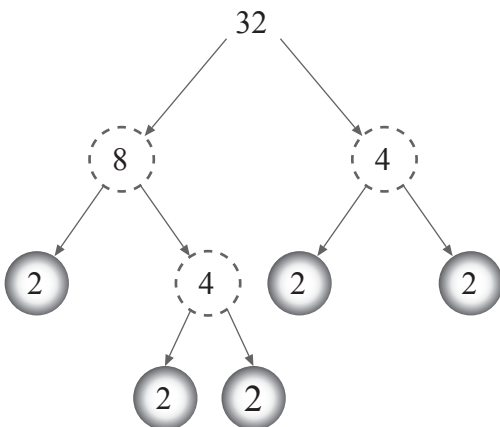
1



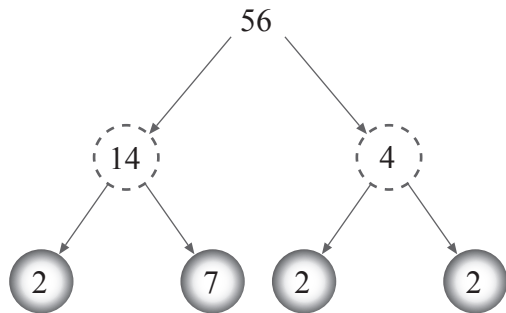
$$\therefore 12 = 2^2 \times 3$$



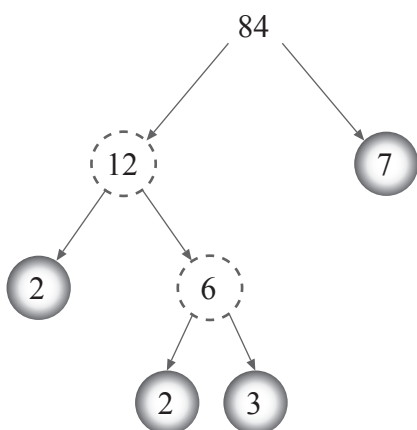
$$\therefore 18 = 2 \times 3^2$$



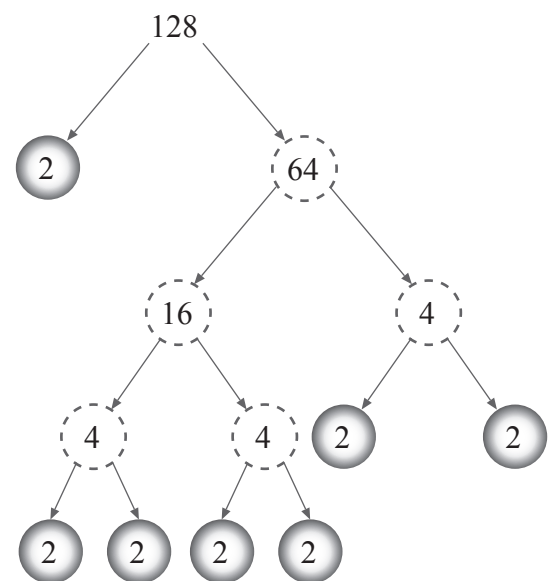
$$\therefore 32 = 2^5$$



$$\therefore 56 = 2^3 \times 7$$



$$\therefore 84 = 2^2 \times 3 \times 7$$

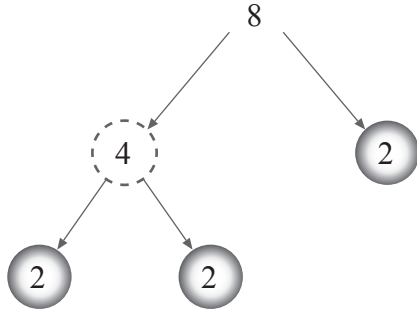


$$\therefore 128 = 2^7$$

Page 40 questions

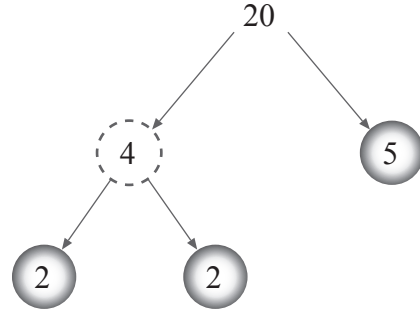
Factor Trees

2 a



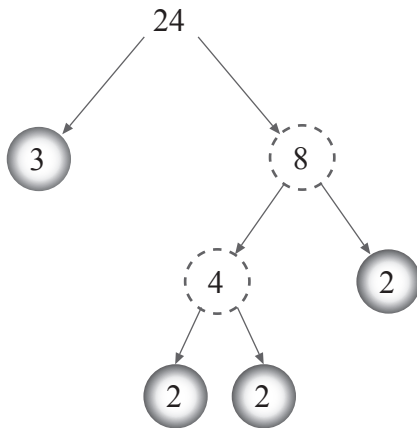
$\therefore 8 = 2^3$

b



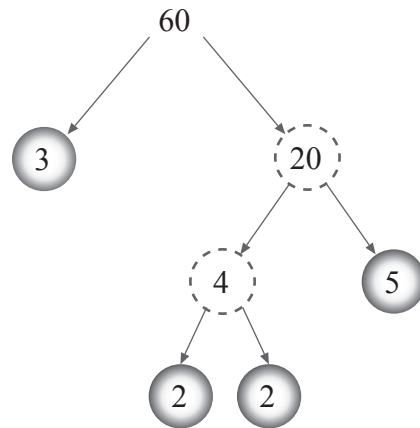
$\therefore 20 = 2^2 \times 5$

c



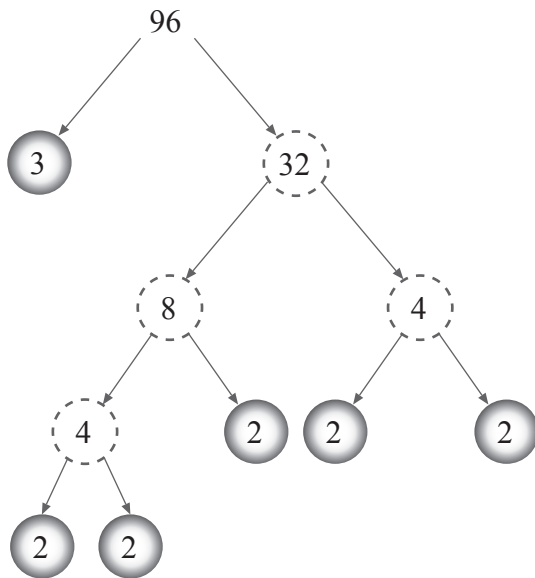
$\therefore 24 = 2^3 \times 3$

d



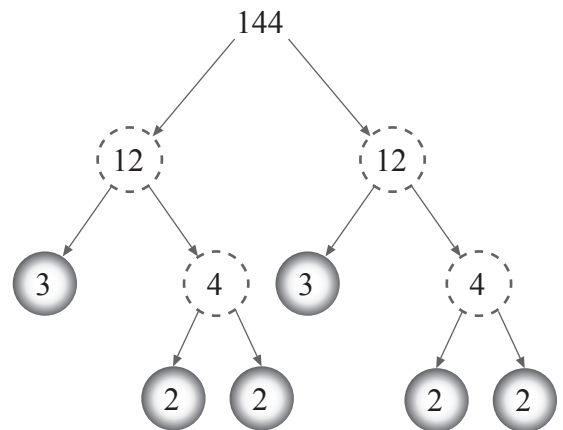
$\therefore 60 = 2^2 \times 3 \times 5$

e



$\therefore 96 = 2^5 \times 3$

f



$\therefore 144 = 2^4 \times 3^2$

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Highest common factor (HCF)

1 Find the highest common factor for these pairs of numbers.**a** 8 and 12Factors of 8: 1 , 2 , **4** , 8Factors of 12: 1 , 2 , 3 , **4** , 6 , 12∴ The HCF for 8 and 12 is: **4****b** 6 and 15Factors of 6: 1 , 2 , **3** , 6Factors of 15: 1 , **3** , 5 , 15∴ The HCF for 6 and 15 is: **3****c** 10 and 18Factors of 10: 1 , **2** , 5 , 10Factors of 18: 1 , **2** , 3 , 6 , 9 , 18∴ The HCF for 10 and 18 is: **2****d** 18 and 24Factors of 18: 1 , 2 , 3 , **6** , 9 , 18Factors of 24: 1 , 2 , 3 , 4 , **6** , 8 , 12 , 24∴ The HCF for 18 and 24 is: **6****e** 14 and 28Factors of 14: 1 , 2 , 7 , **14**Factors of 28: 1 , 2 , 4 , 7 , **14** , 28∴ The HCF for 14 and 28 is: **14****f** 16 and 36Factors of 16: 1 , 2 , **4** , 8 , 16Factors of 36: 1 , 2 , 3 , **4** , 6 , 9 , 12 , 18 , 36∴ The HCF for 16 and 36 is: **4**

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Highest common factor (HCF)

2 Use the prime factors to find the HCF for these larger numbers.

a 42 and 84

Prime factors of 42: (2) , (2) , 2, 2, (3) Prime factors of 84: (2) , (2) , (3) , 7 \therefore The HCF for 42 and 84 is: $2 \times 2 \times 3 = 12$

b 92 and 72

Prime factors of 92: (2) , (2) , 23Prime factors of 72: (2) , (2) , 2, 3, 3 \therefore The HCF for 92 and 72 is: $2 \times 2 = 4$

c 280 and 490

Prime factors of 280: (2) , 2, 2, (5) , (7) Prime factors of 490: (2) , (5) , (7) , 7 \therefore The HCF for 280 and 490 is: $2 \times 5 \times 7 = 70$

d 256 and 640

Prime factors of 256: (2) , (2) , (2) , (2) , (2) , (2) , (2) , 2Prime factors of 640: (2) , (2) , (2) , (2) , (2) , (2) , (2) , 5 \therefore The HCF for 256 and 640 is: $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$

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Lowest common multiple (LCM)

1 Find the lowest common multiple for these pairs of numbers.**a** 3 and 9Multiples of 3: 3 , 6 , **9** , 12 , ...Multiples of 9: **9** , 18 , ... \therefore The LCM for 3 and 9 is: **9****b** 5 and 10Multiples of 5: 5 , **10** , 15 , ...Multiples of 10: **10** , 20 , ... \therefore The LCM for 5 and 10 is: **10****c** 4 and 6Multiples of 4: 4 , 8 , **12** , 16 , ...Multiples of 6: 6 , **12** , 18 , ... \therefore The LCM for 4 and 6 is: **12****d** 5 and 6Multiples of 5: 5 , 10 , 15 , 20 , 25 , **30** , ...Multiples of 6: 6 , 12 , 18 , 24 , **30** , ... \therefore The LCM for 5 and 6 is: **30****e** 6 and 7Multiples of 6: 6 , 12 , 18 , 24 , 30 , 36 , **42** , 48 , ...Multiples of 7: 7 , 14 , 21 , 28 , 35 , **42** , ... \therefore The LCM for 6 and 7 is: **42****f** 12 and 16Multiples of 12: 12 , 24 , 36 , **48** , 60 , 72 , ...Multiples of 16: 16 , 32 , **48** , 64 , ... \therefore The LCM for 12 and 16 is: **48**

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Lowest common multiple (LCM)

- 2 Use the prime factors to find the LCM for these larger numbers.

Steps taken

- List all the **prime** factors for both numbers
- Circle **all** the **different** factors in the smaller number
- Multiply the larger number by the **different** factor

- a 60 and 108

Prime factors of 60: 2 , 2 , 3 , 5

Prime factors of 108: 2 , 2 , 3 , 3 , 3

 \therefore The LCM for 60 and 108 is: $108 \times 5 = 540$

- b 42 and 150

Prime factors of 42: 2 , 3 , 7

Prime factors of 150: 2 , 3 , 5 , 5

 \therefore The LCM for 42 and 150 is: $150 \times 7 = 1050$

- c 168 and 180

Prime factors of 168: 2 , 2 , 2 , 3 , 7

Prime factors of 180: 2 , 2 , 3 , 3 , 5

 \therefore The LCM for 168 and 180 is: $180 \times 2 \times 7 = 2520$

- d 210 and 385

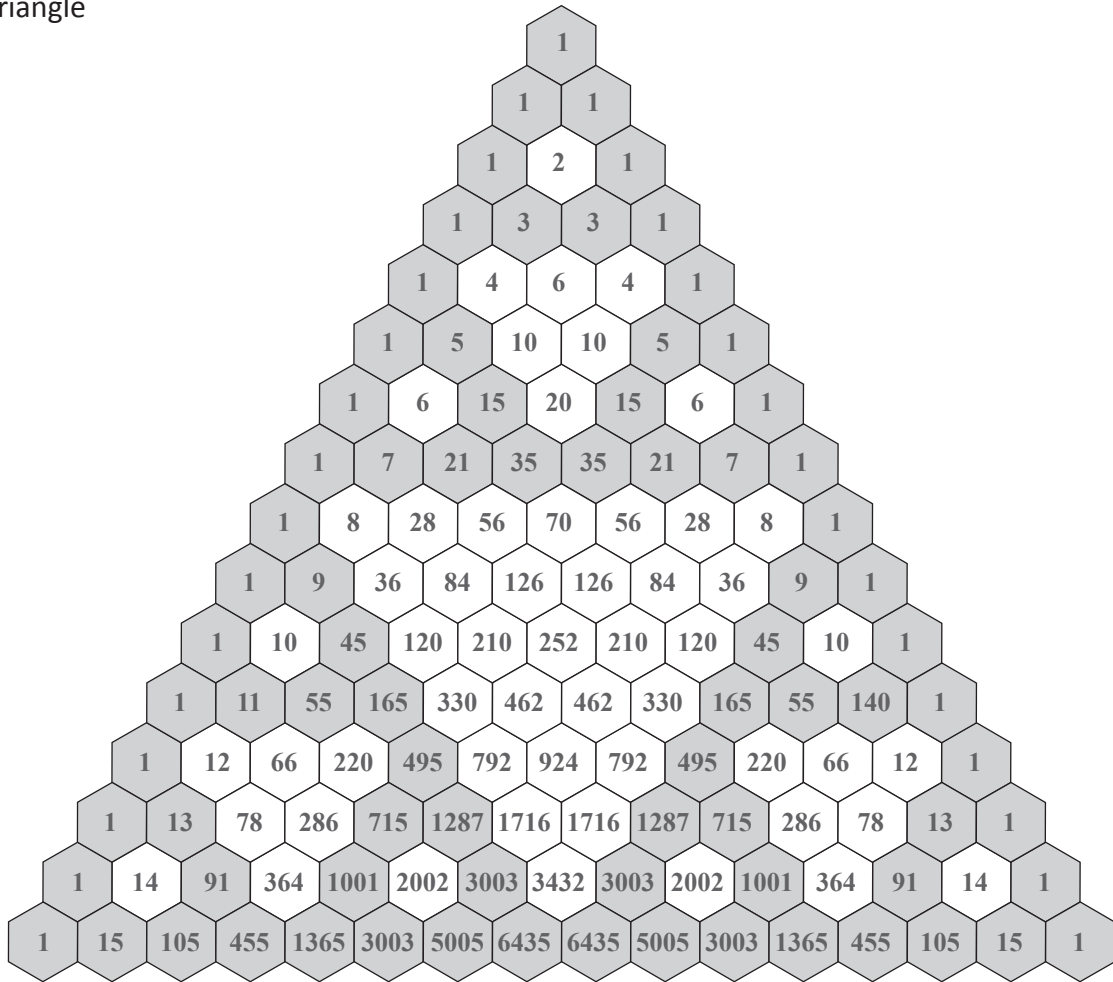
Prime factors of 210: 2 , 3 , 5 , 7

Prime factors of 385: 5 , 7 , 11

 \therefore The LCM for 210 and 385 is: $385 \times 2 \times 3 = 2310$

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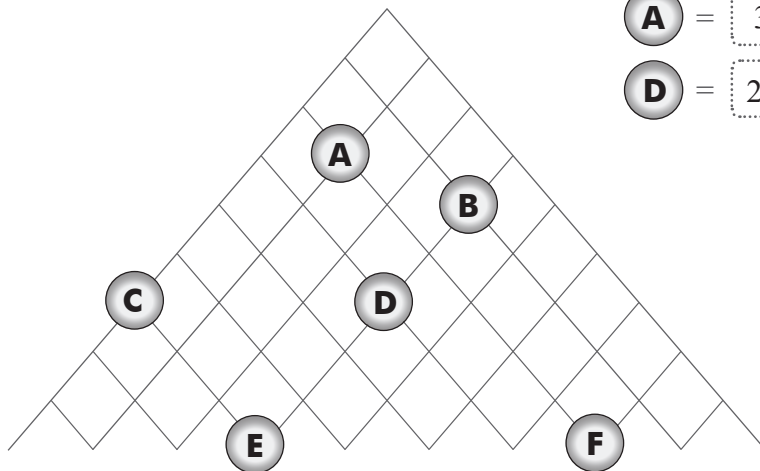
Pascal's Triangle



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Applications of Pascal's Triangle

1



A = 3

B = 4

C = 1

D = 20

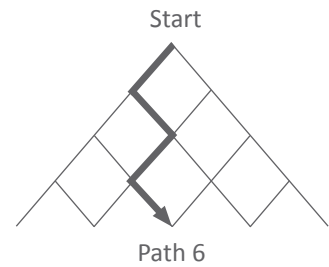
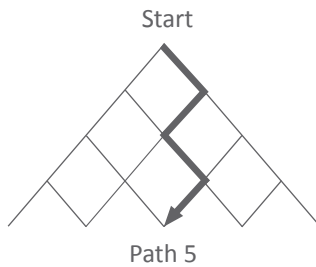
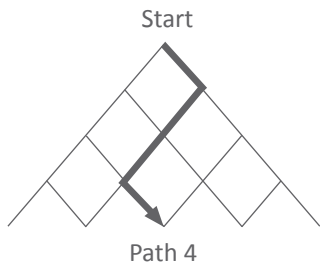
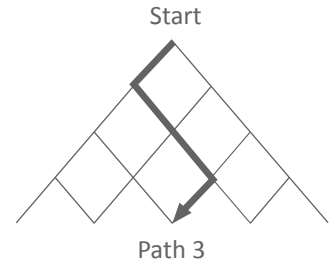
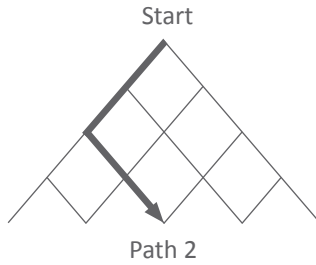
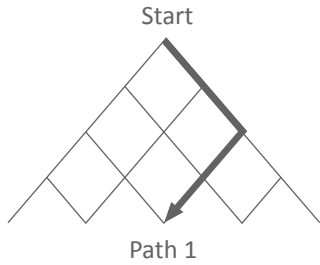
E = 84

F = 36

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Applications of Pascal's Triangle

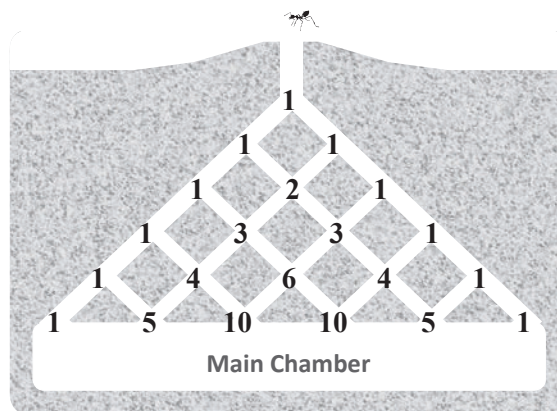
2



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Applications of Pascal's Triangle

3



The total number of different pathways the ant can travel downwards to the main chamber

$$= 1 + 5 + 10 + 10 + 5 + 1$$

$$= 32$$



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