WelTec Mathematics Series

Multiplication

All trades based jobs will require you to use multiplication to a certain extent. Additionally, you will probably need to be able to add, subtract and divide fairly accurately to make sure you're able to do what work you need to do as well.

In order to be able to multiply well, you'll need to understand the place value of the digits that make up a number. This has been covered in another handout.

Multiplication

The result of subtracting numbers is called the **product**. The **multiplication sign** (x) tells you have to multiply. Multiplication is a short method for adding equal amounts. For example, 4 times 5 (4 x 5) means 4 fives or 5 + 5 + 5 + 5.

Numbers can be multiplied in any order. The same product is obtained regardless of whatever order the numbers are multiplied. For example, 4 x 3 = 3 x 4. This is called the **commutative** property of multiplication.

Example 1

Multiply 386 x 7.

Solution

In expanded form the addition would look like this:

Expanded Form	Shorter Form
3 hundreds + 8 tens + 6 ones	386
x 7	x 7
21 hundreds + 56 tens + 42 ones	42
2100 + 560 + 42	560
2702	2100
	2702

Short Multiplication

Short multiplication is used to work out the product of two numbers when the multiplier only has one digit in it. For example a problem such as 7 x 386 is one where short multiplication is used.

Example 2 – Process for Short Multiplication

Multiply 7 x 386.

Estimate the answer

7 x 400 = 2800

Work out the answer

1. Write the multiplier under the unit digit of the number
   Multiply the 7 by the unit digit i.e. 6.
   7 x 6 = 42
   Write 2 in the unit position of the answer

2. Multiply the 7 by the tens digit of the number
   7 x 8 = 56
   Add the 4 tens from the product of the units
   56 = 4 = 60
   Write the 0 in the tens position of the answer

3. Multiply the 7 by the hundreds of the number
   7 x 3 = 21
   Add the 6 hundreds from the product of the tens
   21 + 6 = 27
   Write 7 in the hundreds position
   Write 2 in the thousands position

4. Check the answer to the estimate
   2702 is about the same as 2800

```
  386 x
      7
  2702
    6 4
```

Question 1

Estimate each of the following products to the indicated place value.

a) 75 x 8 (nearest ten)
b) 775 x 5 (nearest ten)
c) 1877 x 9 (nearest 100)
d) 54,157 x 8 (nearest 1000)
e) 1804 x 3 (nearest hundred)
f) 12,199 x 5 (nearest thousand)
g) 456,900 x 4 (nearest thousand)
h) 318,234 x 8 (nearest thousand)
i) 2,132,512 x 9 (nearest ten thousand)

Long Multiplication

Short multiplication is used to work out the product of two numbers when the multiplier has two or more digits in it. For example a problem such as 436 x 7812 is one where long multiplication is used.

Example 3 – Process for Long Multiplication

Multiply 436 x 7812.

Estimate the answer

Round 436 to 400 and 7812 to 8000

400 x 8000 = 3,200,00

Work out the answer

1. Write the multiplier under the number, putting the digits in their correct position Multiply the number by the units of the multiplier, using the procedure for short multiplication. This gives the first answer.

6 x 7812 = 46,872

Write this answer starting in the units position.

2. Multiply the number by the tens digit of the multiplier to get the second answer.
   3 x 7812 = 23,436
   Write this second answer under the first answer, starting in the tens position

3. Multiply the number by the hundreds of the multiplier to get the third answer.
   4 x 7812 = 31,248
   Write the third answer in the hundreds position

4. Add the three answers to get the product

5. Check the answer to the estimate
   3,406,032 is about the same as 3,200,000

```
        7812 x
         436
   ─────────
        46872  ⎤
        23436  ⎬  +
        31248  ⎦
   ─────────
      3406032
```

Question 2

Estimate each of the following products to the indicated place value.

  a) 914 x 67 (nearest ten)
  b) 12,737 x 79 (nearest ten)
  c) 7816 x 513 (nearest 100)
  d) 23,418 x 1147 (nearest 1000)
  e) 15,553 x 999 (nearest hundred)
  f) 327,800 x 274 (nearest thousand)
  g) 405,607 x 112 (nearest thousand)
  h) 419 x 7635 (nearest thousand)
  i) 423 x 63,940 (nearest ten thousand)

Question 3

Multiply the following numbers and then compare your answers to the estimates you calculated in questions 1 and 2.

a) 75 x
   8

b) 775 x
   5

c) 54,157 x
   8

d) 6 x 523   e) 3 x 1804

f) 5 x 12,199   g) 4 x 456,900   h) 8 x 318,234   i) 9 x 2,132,512

j) 57 x
   81

k) 914 x
   67

l) 12,737 x
   79

m) 7816 x
   513

n) 15,553 x
   999

o) 23,418 x
   1147

p) 327,800 x
   274

q) 405,607 x
   112

r) 419 x 7,635   s) 423 x 63,940

t) 2,561 x 17,738   u) 1,176 x 62,347   v) 4,214 x 18,919   w) 943 x
   70

x) 1798 x
   507

y) 7100 x
   590

z) 8009 x
   400

Answers

a) 75 x
   8
___
600

b) 775 x
   5
___
3875

c) 54,157 x
   8
___
433400

d) 523 x
   6
___
3138

e) 1804 x
   3
___
5412

f) 12,199 x
   5
___
60995

g) 456,900 x
   4
___
182,7600

h) 318,234 x
   8
___
254,5872

i) 2,132,512 x
   9
___
19,192,608

j) 57 x
   81
___
57
456
___
4617

k) 914
   67
___
6398
5484
___
61238

l) 12,737 x
   79
___
114633
89159
___
1006223

m) 7816 x
   513
___
23448
7816
39080
___
4009608

n) 15,553 x
   999
___
139977
139977
139977
___
15537447

o) 23,418 x
   1,147
___
163926
93672
23418
23418
___
26860446

p) 327,800 x
   274
___
1311200
2294600
655600
___
89817200

q) 405,607 x
   112
___
811214
405607
405607
___
45427984

Multiplying Whole Numbers in Practical Applications

Example 4

The total cost of fixtures and lights for an office lighting installation is found by an electrician. The following fixtures and lights are:

➢ 12 incandescent fixtures at $18 each.
➢ 22 indirect fluorescent lights at $37 each
➢ 33 direct fluorescent lights at $28 each.

Find the total cost.

Solution

Work out the process

Multiply the required number of each light or fixture by the cost of each. The total cost is the sum of the products.

Estimate the answer

Total cost = (10 x $20) + (20 x $40) + (30 x $30)

     = $200 + $800 + $900

     = $1900

Work out the answer

Total cost = (12 x $18) + (22 x $37) + (33 x $28)

     = $216 + $814 + $924

     = $1954

Check the answer to the estimate

$1954 is about the same as $1900.

Question 4

An offset press feeds at a rate of 2,050 impressions per hour. How many impressions can a press operator print in 14 hours?

Answers

2,050 x 14

2050 x
14
8200
2050 +
28700

So, there are 28700 impressions in 14 hours.

Question 5

An engineer works out the total weight of I beams required for a building. The table below lists the data used in finding the weight. Find the total weight of the I beams for the building.

	75mm x 40mm Weight: 36kg/m	100mm x 50mm Weight: 25kg/m	150mmx 75mm Weight: 15kg/m
Number of 3m lengths	15	0	24
Number of 5m lengths	12	18	7
Number of 6m lengths	8	32	25
Number of 9m lengths	17	8	0

Total length of 75mm x 40mm beams = (3m x 15) + (5m x 12) + (6m x 8) + (9m x 17)

=   45m   +   60m   +   48m   +   153m

=   306m

Total weight of the 75mm x 40mm beams = 306m x 36kg/m

= 11,016 kg

Total length of 100mm x 50mm beams = (3m x 0) + (5m x 18) + (6m x 32) + (9m x 8)

=   0m   +   90m   +   192m   +   72m

=   354m

Total weight of the 100mm x 50mm beams = 354m x 25kg/m

= 8,850 kg

Total length of 150mm x 75mm beams = (3m x 24) + (5m x 7) + (6m x 25) + (9m x 0)

=   72m   +   35m   +   150m   +   0m

=   257m

Total weight of the 150mm x 75 mm beams = 257m x 15kg/m

= 3,855 kg

Total weight of the I beams = 11,016 kg + 8,850 kg + 3,855 kg

= 23,721 kg