

# Answers for Unit A

## 1 Working with numbers

### Using your calculator

#### Answers to NTTEQ

- 1 a 454.35      b 36.96      c 1.68  
2 a 0.02 or  $\frac{1}{50}$       b 1.33      c  $\frac{1}{9}$  or 0.11  
3 a 120 g      b  $\frac{19}{20}$       c £15.20  
4 a 847.51      b 2.41      c 1.03

#### Answers to MEP

- 1 a 11.56      b  $\frac{2}{5}$       c 9  
2 a  $7\frac{5}{12}$       b  $\frac{19}{21}$       c  $\frac{9}{35}$   
3 a 15 625      b 5.57      c 6.4  
4 £13 526

### Accuracy of answers

#### Answers to NTTEQ

- 1 2 significant figures

#### Answers to MEP

- 1 a The answer should be 3.  
3.0 suggests 2 significant figures.  
b 70  
2 a 147      b 100      c 147.0  
3 a 180      b 1050

### Prime factors

#### Answers to NTTEQ

- 1 a 64      b 125      c 256  
2 a  $30 = 2 \times 15$   
 $= 2 \times 3 \times 5$   
b 3  
3  $10 = 2 \times 5$   
 $12 = 2 \times 2 \times 3$   
 $20 = 2 \times 2 \times 5$   
HCF = 2  
LCM =  $2 \times 2 \times 3 \times 5$   
 $= 60$

#### Answers to MEP

- 1 a  $24 = 2 \times 12$   
 $= 2 \times 2 \times 6$   
 $= 2 \times 2 \times 2 \times 3$   
 $= 2^3 \times 3$   
b  $60 = 2 \times 30$   
 $= 2 \times 2 \times 15$   
 $= 2 \times 2 \times 3 \times 5$   
 $= 2^2 \times 3 \times 5$   
LCM of 24 and 60 =  $2 \times 2 \times 2 \times 3 \times 5$   
 $= 120$   
2 a  $48 = 2 \times 24$   
 $= 2 \times 2 \times 12$   
 $= 2 \times 2 \times 2 \times 6$   
 $= 2 \times 2 \times 2 \times 2 \times 3$   
 $= 2^4 \times 3$   
b  $72 = 2 \times 36$   
 $= 2 \times 2 \times 18$   
 $= 2 \times 2 \times 2 \times 9$   
 $= 2 \times 2 \times 2 \times 3 \times 3$   
 $= 2^3 \times 3^2$   
HCF of 48 and 72 =  $2^3 \times 3$   
 $= 8 \times 3$   
 $= 24$   
3 80, 82, 84, 86 and 88 have 2 as a factor; 81 and 87 have 3 as a factor; 85 has 5 as a factor. So 83 is the only one with just itself and 1 as factors.

## 2 Algebra

#### Answers to NTTEQ

- 1  $5s^3 - 10s$   
2  $5a + 10 - 3a + 3 = 2a + 13$   
3  $2x(2x - 1)$

#### Answers to MEP

- 1  $5x^2 - 15x$   
2  $6a^2 + 12a$   
3  $6x + 2 - 4x + 12 = 2x + 14$   
4 a  $5(a - 2b)$       b  $x(x + 7)$

### 3 Statistical diagrams

#### Answers to NTTEQ

1 a Ordered

1									
2	1	4							
3	4								
4	3	4	8						
5	5	6	8						
6	1	4	5	9					
7	2	2	3	4	6	6	8	8	9
8	1	1	1	2	2	9			
9	1	2	5	8	9				

Key: 2 | 1 means 21

b 74

Average leaf length about the same

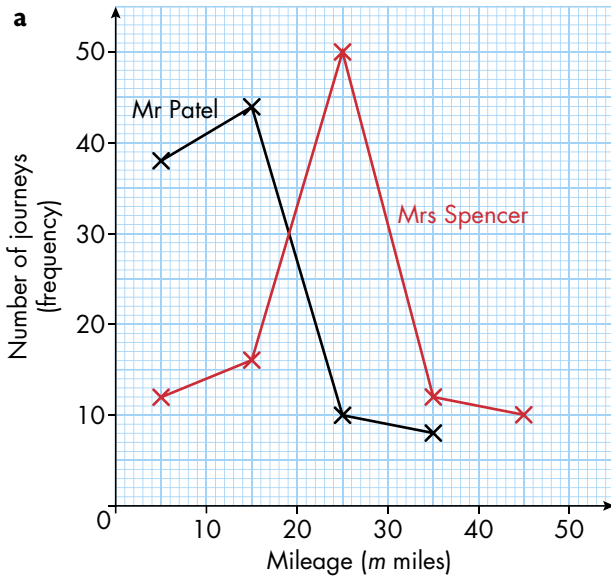
2 (Median: Tree A 7.2 cm, Tree B 7.3 cm).

Length of leaves more spread out for Tree A

(Range: Tree A 4.2 cm, Tree B 2.3 cm).

#### Answers to MEP

1 a

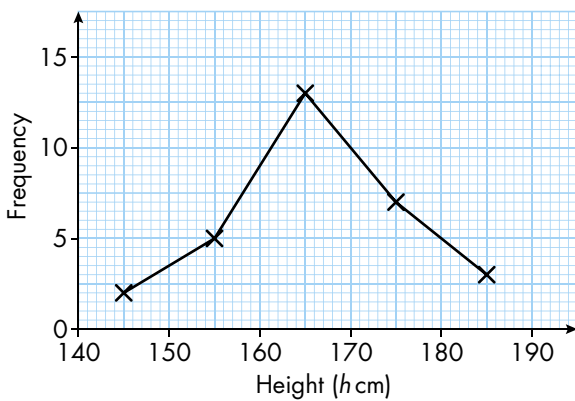


b e.g. Mr Patel had more shorter journeys.

Mr Patel had none over 40.

Mrs Spencer did more miles overall.

2



### 4 Equations

#### Answers to NTTEQ

1  $3m = 9 \times 4$

$$m = 36 \div 3$$

$$m = 12$$

2  $2y + 6 = 5y$

$$6 = 5y - 2y$$

$$3y = 6$$

$$y = 6 \div 3$$

$$y = 2$$

3  $4x + 8 + 6x - 4 = 14$

$$4x + 6x = 14 - 8 + 4$$

$$10x = 10$$

$$x = 1$$

#### Answers to MEP

1  $5x - 10 = 25$

$$5x = 25 + 10$$

$$5x = 35$$

$$x = 35 \div 5$$

$$x = 7$$

2  $4a + 12 = 18$

$$4a = 18 - 12$$

$$4a = 6$$

$$a = 6 \div 4$$

$$a = 1\frac{1}{2}$$

3  $3x - x = 1$

$$2x = 1$$

$$x = \frac{1}{2}$$

4  $3p - p = 8 + 4$

$$2p = 12$$

$$p = 12 \div 2$$

$$p = 6$$

5  $4x - 4 = 2x + 3$

$$4x - 2x = 3 + 4$$

$$2x = 7$$

$$x = 7 \div 2$$

$$x = 3\frac{1}{2}$$

## 5 Ratio and proportion

### Answers to NTTEQ

- 1 a Gold =  $15 \times \frac{7}{3}$   
= 35 g
- b Total parts = 10  
Multiplier =  $20 \div 10$   
= 2  
Gold =  $7 \times 2$   
= 14 g
- 2 Mixed fruit =  $100 \times \frac{25}{10}$   
= 250 g  
Flour =  $250 \times \frac{25}{10}$   
= 625 g
- 3 Multiplier =  $420 \div 7$   
= 60
- a Vans = 60  
b Cars =  $6 \times 60$   
= 360
- 4 Multiplier =  $7000 \div 15 = 466.666$   
Adrian receives  $2 \times 7000 \div 15 = \pounds 933.33$   
Penelope receives  $5 \times 7000 \div 15 = \pounds 2333.33$   
Gladys receives  $8 \times 7000 \div 15 = \pounds 3733.33$   
Check total:  $933.33 + 2333.33 + 3733.33 = 6999.99$   
(Notice 1p out due to rounding errors.)

5

Pack	Size	Price	Price per gram
Standard	500g	£1.15	0.23p
Family	750g	£1.59	0.212p
Special	1.2 kg	£2.49	0.2075p

Special is the best value for money.

- 6 Amount in dollars =  $500 \times 1.93$   
= \$965  
Amount left =  $\$965 - \$784$   
= \$181  
Received back  $181 \div 1.93 = \pounds 93.78$
- 7 Charge for 14 days =  $27.50 + 9 \times 4.50$   
= £68

### Answers to MEP

- 1 5 parts  
Multiplier =  $250 \div 5$   
= 50  
Lead = 50 g
- 2 Total parts =  $16 + 19 + 25$   
= 60  
Multiplier =  $13\,500 \div 60$   
= 225  
Helen  $16 \times 225 = \pounds 3600$   
Jessica  $19 \times 225 = \pounds 4275$   
Rebecca  $25 \times 225 = \pounds 5625$

- 3 Multiplier =  $21.6 \div 3$   
= 7.2  
Total =  $7.2 \times 5$   
= £36
- 4 Total parts =  $3 + 8 + 9$   
= 20  
a Multiplier =  $250 \div 20$   
= 12.5  
Water =  $8 \times 12.5$   
= 100 ml  
b Multiplier =  $45 \div 3$   
= 15  
Total =  $15 \times 20$   
= 300 litres
- 5 Total parts =  $2 + 3 + 7$   
= 12  
Multiplier =  $6492 \div 12$   
= 541  
Lorries =  $2 \times 541$   
= 1082
- 6 3 litres =  $150 \div 3$   
= 50p a litre  
2 litres =  $110 \div 2$   
= 55p a litre  
750 ml =  $37 \div 750 \times 1000$   
= 49.33p a litre  
750 ml is best buy

## 6 Statistical calculations

### Answer to NTTEQ

- 1 Mean  
=  $\frac{45 \times 14 + 46 \times 25 + 47 \times 32 + 48 \times 19 + 49 \times 8 + 50 \times 2}{14 + 25 + 32 + 19 + 8 + 2}$   
= 46.88

### Answers to MEP

- 1  $\frac{145 \times 2 + 155 \times 5 + 165 \times 3 + 175 \times 7 + 185 \times 3}{2 + 5 + 13 + 7 + 3}$   
= 166.3 cm
- 2  $\frac{55 \times 23 + 65 \times 42 + 75 \times 50 + 85 \times 20 + 95 \times 15}{23 + 42 + 50 + 20 + 15}$   
= 72.5 to 1 d.p.

## 7 Pythagoras' theorem

### Using Pythagoras' theorem

#### Answers to TTEQ

- 1  $a^2 = b^2 + c^2$   
 $= 4.6^2 + 5.0^2$   
 $= 46.16$   
 $a = \sqrt{46.16}$   
 $a = 6.8 \text{ cm (to 1 d.p.)}$
- 2 Length of diagonal  $= \sqrt{20^2 + 5^2 + 3^2}$   
 $= 20.83 \text{ cm}$   
 So the pencil won't fit.

#### Answers to MEP

- 1  $a^2 = b^2 + c^2$   
 $9.1^2 = b^2 + 7.8^2$   
 $b^2 = 9.1^2 - 7.8^2$   
 $b^2 = 21.97$   
 $b = \sqrt{21.97}$
- So  $x = 4.7 \text{ cm (to 1 d.p.)}$
- 2  $a^2 = b^2 + c^2$   
 $a^2 = 4.2^2 + 1.8^2$   
 $a^2 = 20.88$   
 $a = \sqrt{20.88}$   
 $a = 4.6 \text{ cm (to 1 d.p.)}$

#### Answers to TTEQ

- 1 Midpoint  $= \left( \frac{5+8}{2}, \frac{4+(-2)}{2} \right)$   
 $= (6.5, 1)$
- Length  $= \sqrt{(8-5)^2 + (4-(-2))^2}$   
 $= \sqrt{3^2 + 6^2}$   
 $= 6.7 \text{ cm (to 1 d.p.)}$

## 8 Formulae 1

#### Answers to NTTEQ

- 1  $s = 9 \times 48 + \frac{1}{2} \times \left(-\frac{1}{4}\right) \times 48^2$   
 $s = 432 - 288$   
 $s = 144$
- 2  $2(C + 15) = F$   
 $2C + 30 = F$   
 $2C = F - 30$   
 $C = \frac{F-30}{2}$  or  $C = \frac{F}{2} - 15$
- 3  $5d + 3 = e$   
 $5d = e - 3$   
 $d = \frac{e-3}{5}$

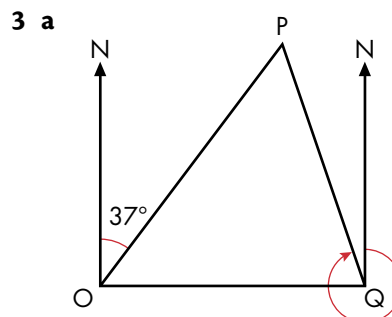
## Answers to MEP

- 1  $C - 120 = 4n$   
 $\frac{C - 120}{4} = n$   
 $n = \frac{C - 120}{4}$
- 2  $6y = 30 - 5x$   
 $y = \frac{30 - 5x}{6} = \frac{5}{6}(6 - x)$
- 3  $f = \frac{14.9 \times -10.2}{14.9 + -10.2}$   
 $f = -32.3$  to 3 s.f.
- 4 **a** Identity                      **b** Expression  
**c** Formula                      **d** Equation
- 5  $15x - 7 = 8x + 7x - 5 + -2$
- 6  $3a^2 - 21a + ca + d = 3a^2 + 10a + 1$   
 $d = 1$   
 $-21a + ca = 10a$   
 $c = 31$

## 9 Measures

#### Answers to NTTEQ

- 1 **a** 48 to 53 kg  
**b** 1.5 m
- 2 He pours out  $5 \times 33 = 165 \text{ ml}$   
 $1.5 \text{ litres} = 1500 \text{ ml}$   
 so amount left in bottle  $= 1500 - 165 = 1335 \text{ ml}$  or  
 $1.335 \text{ litres}$



- b** PQ measures 3.4 cm on the diagram, so is  
 $3.4 \times 2 = 6.8 \text{ km}$
- c**  $341^\circ$

#### Answers to MEP

- 1 **a** Between 3.5 m and 5 m  
**b i** 34 mph  
**ii** Between  $47^\circ\text{C}$  and  $48^\circ\text{C}$
- 2 **a**  $160 + 160 = 320 \text{ cm} = 3.2 \text{ m}$   
**b**  $10 - 3.2 = 6.8 \text{ m}$  or 680 cm
- 3 14.15 m or 1415 cm
- 4 15 litres

## 10 Planning and collecting

### Answers to NTTEQ

- 1 a Wasim: Too few groups  
Abbie: Overlap, e.g. 10 in two groups

b

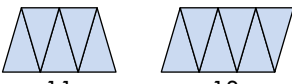
Cars	Tally	Frequency
0-9		3
10-19		10
20-29		12
30-39		6
40-49		3
50-59		2

### Answers to MEP

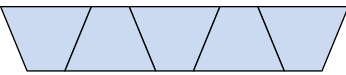
- 1 For example  
a a leading question  
b question is asking two things at once

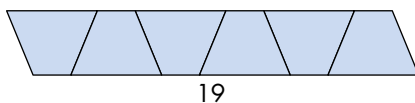
## 11 Sequences

### Answers to NTTEQ

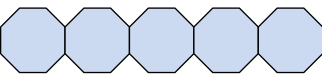
- 1 a i   
11      13

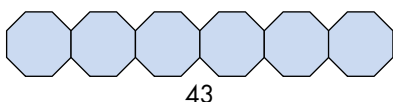
ii Add 2

- b i   
16



ii Add 3

- c i   
36



iii Add 7

- 2 a 42, 77  
b Yes. You alternately add two odd and one even number (giving an even number) and add two even numbers and one odd number (giving an odd number).

- 3 a Difference = 7 so rule is  $7n + k$ .  
 $k = \text{First term} - \text{common difference} = 1 - 7 = -5$ ,  
so rule is  $7n - 5$ .  
b If  $7n - 5 = 300$  then  $7n = 305$  and  $n = 305 \div 7$ .  
Therefore  $n = 43.57$  i.e.  $n$  is not a whole number  
therefore 300 is not in the sequence.

- 4 a 

<b>t</b>	1	2	3
<b>c</b>	4	8	12

 $c = 4t$

- b 

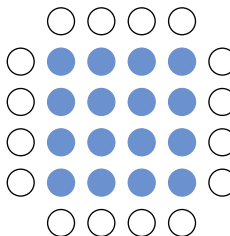
<b>t</b>	1	2	3
<b>c</b>	4	6	8

 $c = 2t + 2$

Difference = 2 so rule is  $c = 2t + k$ .  
First term - common difference =  $4 - 2 = 2$ ,  
so rule is  $c = 2t - 2$ .

### Answers to MEP

- 1 a i 26, 31      ii Add 5  
b i 6, 3      ii Subtract 3  
c i 81, 243      ii Multiply by 3  
2 a i 9, 13, 17  
ii By adding 4  
or i 25, 125, 625  
ii By multiplying by 5  
or i 10, 16, 23  
ii By adding the difference +1 each time  
b Any other one of the sequence not used in part a.

- 3 a 

b

Pattern number	1	2	3	4
Number of black dots	1	4	9	16
Number of white dots	4	8	12	16

- c Square numbers  
d Multiples of 4  
4 Rule is  $5n - 2$   
50th term =  $5 \times 50 - 2 = 248$

## 12 Constructions and loci

### Answers to NTTEQ

1 b  $AX = 4.8 \text{ cm}$

2

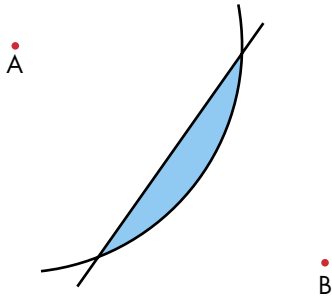


Diagram shown half-size.

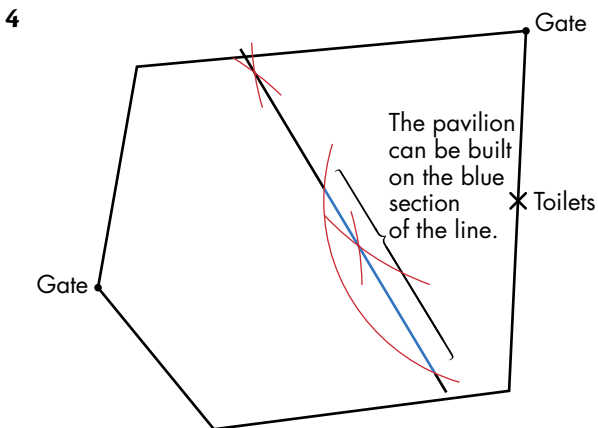
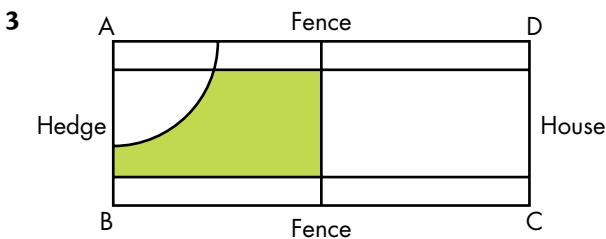
### Answers to MEP

When you have to take a measurement from your diagram, answers within 2 mm or  $2^\circ$  of the answers given below are acceptable.

1 b AC is approximately 4.5 cm

2  $MZ = 2.9 \text{ cm}$

For Questions 3 and 4, the diagrams are not shown full-size.



## 13 Sampling

### Answers to NTTEQ

- 1 a Advantage: cheaper, quicker  
Disadvantage: may not be representative
- b May be biased, e.g. may be in friendship or year groups or could have all just got off school buses

- c Number all students. Select random numbers, e.g. raffle tickets, random number generator, until she has 10%
- d Ensures all groups represented, e.g. each stratum is a year group
- 2 a Strata different areas, council tax bands, flats, two-bedroom, three-bedroom, etc. Then select 10% sample from each stratum
- b Ensures all types of household represented
- c May not give a representative sample, only gets those in phone book not those with no phone, ex-directory, etc

### Answers to MEP

- 1 a Give every student in school a number. Choose 90 numbers using e.g. raffle tickets, random number generator. Choose students corresponding to numbers.
- b Stratified
- c Ensures every year group represented proportionately and older students may get more homework
- d Quicker
- 2 Census: whole population is surveyed.  
Advantage: accurate.  
Disadvantage: cost, time, etc.  
Sample: only a proportion of the population are sampled.  
Advantage: cheaper, less time consuming, census may be impossible  
Disadvantage: may not be accurate due to difficulty of obtaining representative sample.

## 14 Trigonometry

### Answers to NTTEQ

- 1 a 4.7 cm  
b  $62.34^\circ$  or  $62^\circ$
- 2  $x = 5.2 \text{ cm}$   
 $y = 7.89 \text{ cm}$  or  $7.9 \text{ cm}$

### Answers to MEP

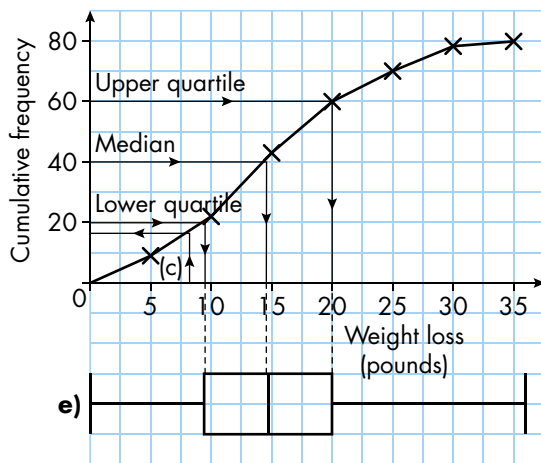
- 1 a 8.54 m      b 1.07 m      c 8.25 m
- 2  $64.6^\circ$
- 3 a 2.57 m      b  $66^\circ$

# 15 Representing and interpreting data

## Answers to MEP

### Answers to NTTEQ

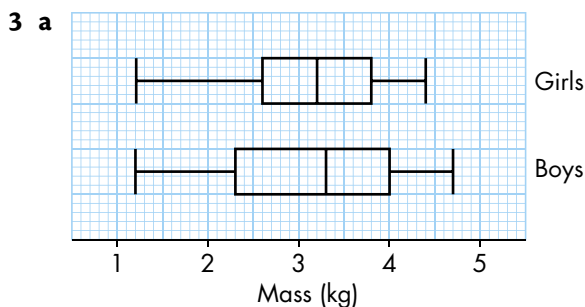
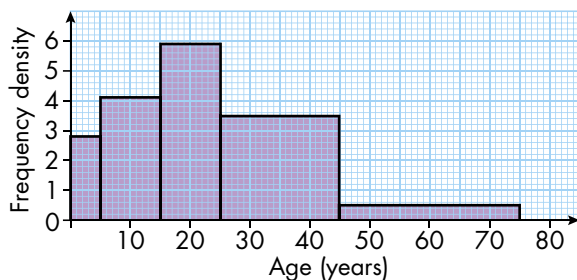
- 1 a i [9], 22, 43, 60, 70, 78, 80  
ii and d



- b i 14 to 14.8 pounds  
ii 10.5 to 11 is acceptable  
c 63 to 65 is acceptable

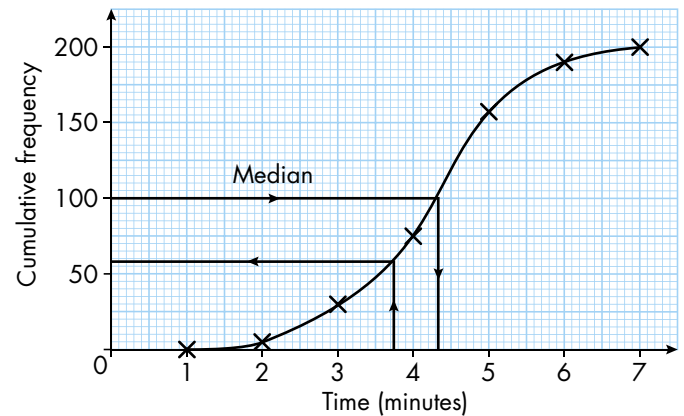
- 2 Frequency densities:

$$\frac{14}{5} = 2.8; \frac{41}{10} = 4.1; \frac{59}{10} = 5.9; \frac{70}{20} = 3.5; \frac{16}{30} = 0.53$$



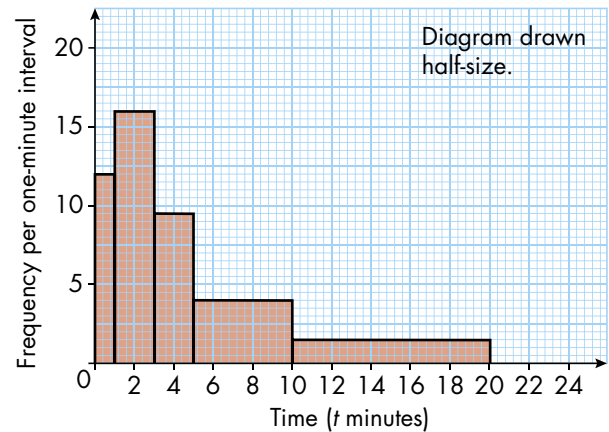
- b For example, boys tend to be heavier, the range for girls is less, the interquartile range for the girls is less, 25% of the boys weigh less than 2.3 kg and 25% of the girls weigh less than 2.6 kg so there are more boys with low masses, girls' masses are more consistent i.e. 50% of the girls have a mass between 2.6 kg and 3.8 kg but for the boys 50% weigh between 2.3 kg and 4.0 kg.

- 1 a i [0], [5], 30, 75, 157, 190, [200]  
ii



- b 4.2 to 4.5 minutes

- 2 Frequency densities 12, 16, 9.5, 4, 1.5



- 3

Time (minutes)	0-20	20-30	30-45	45-60	60-90
Frequency	$1.4 \times 20 = 28$	60	$8.8 \times 15 = 132$	$7.2 \times 15 = 108$	$2 \times 30 = 30$

- 4 a  $32 \times 0.5 + 76 \times 0.5 + 40 \times 0.5 = 16 + 38 + 20 = 74$

- b  $3 \text{ kg} \leq \text{mass} < 3.5 \text{ kg}$

## 16 Formulae 2

### Answers to NTTEQ

- 1  $\frac{p}{5} = \sqrt{v}$   
 $\frac{p^2}{25} = v$   
 $v = \frac{p^2}{25}$

$$2 \quad \frac{1}{3}\pi r^2 h = V$$

$$\pi r^2 h = 3V$$

$$r^2 = \frac{3V}{\pi h}$$

$$r = \sqrt{\frac{3V}{\pi h}}$$

$$3 \quad \mathbf{a} \quad de - 5d = 3$$

$$d(e - 5) = 3$$

$$d = \frac{3}{e - 5}$$

$$\mathbf{b} \quad 3d - 7 = e(4 + 5d)$$

$$3d - 7 = 4e + 5de$$

$$3d - 5de = 4e + 7$$

$$d(3 - 5e) = 4e + 7$$

$$d = \frac{4e + 7}{3 - 5e}$$

$$4 \quad \mathbf{a} \quad f(0.5) = 5 \times 0.5 - 4 = -1.5$$

$$\mathbf{b} \quad 5x - 4 = 0$$

$$5x = 4$$

$$x = 0.8$$

$$\mathbf{c} \quad f(1 + 2x) = 5(1 + 2x) - 4$$

$$= 5 + 10x - 4$$

$$= 10x + 1$$

## Answers to MEP

$$1 \quad \frac{uv}{u+5} = f$$

$$uv = f(u+5)$$

$$v = \frac{f(u+5)}{u}$$

$$2 \quad 120 + 4n^2 = C$$

$$4n^2 = C - 120$$

$$n^2 = \frac{C - 120}{4}$$

$$n = \sqrt{\frac{C - 120}{4}}$$

$$3 \quad 2\pi r(r+h) = S$$

$$2\pi r^2 + 2\pi rh = S$$

$$2\pi rh = S - 2\pi r^2$$

$$h = \frac{S - 2\pi r^2}{2\pi r}$$

$$4 \quad \mathbf{a} \quad f(3) = 1 + 2 \times 3 = 7$$

$$g(3) = 3 - 5 \times 3 = -12$$

$$\mathbf{b} \quad f(2x) = g(x)$$

$$1 + 4x = 3 - 5x$$

$$9x = 2$$

$$x = \frac{2}{9}$$



# Answers for Unit B

## 1 Properties of shapes

### Angles made with parallel lines

#### Answers to TTEQ

- $x = 53^\circ$  Corresponding angles are equal.  
 $y = 84^\circ$  Angles in a triangle add up to  $180^\circ$ .
- $a = 48^\circ$  Angles on a straight line and corresponding angles.  
 $b = 34^\circ$  Angles on a straight line and angles in a triangle.
- $x = 64^\circ$  Alternate angles.  
 $y = 59^\circ$  Angles on a straight line and corresponding angles.

### The angles in a triangle

#### Answers to TTEQ

- a**  $60^\circ$       **b** equilateral      **c**  $80^\circ$
- $x = 73^\circ$  Angles in a triangle add up to  $180^\circ$  and base angles in isosceles triangle are equal.  
 $y = 107^\circ$  Exterior angle equals interior opposite angles of triangle.

### The angles in a quadrilateral

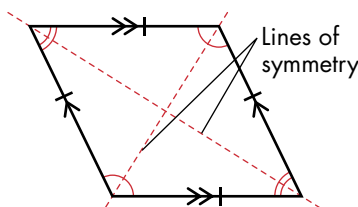
#### Answers to TTEQ

- $128^\circ$

### Special quadrilaterals

#### Answers to TTEQ

- a** and **b**



- c** Order of rotation symmetry is 2.
- $102^\circ$  Angles in a pentagon add up to  $540^\circ$

### The angles in a polygon

#### Answers to NTTEQ

- a**  $350^\circ \div 5 = 72^\circ$   
**b** Isosceles
- $360 \div (180 - 168) = 30^\circ$

## 2 Fractions, decimals and percentages

### Comparing fractions

#### Answers

- a**  $\frac{3}{4} = \frac{30}{40}$ ,  $\frac{7}{10} = \frac{28}{40}$ ,  $\frac{3}{5} = \frac{24}{40}$ ,  $\frac{5}{8} = \frac{25}{40}$   
 Order is  $\frac{24}{40}$ ,  $\frac{25}{40}$ ,  $\frac{28}{40}$ ,  $\frac{30}{40}$  that is  $\frac{3}{5}$ ,  $\frac{5}{8}$ ,  $\frac{7}{10}$ ,  $\frac{3}{4}$

**b**  $66\% = 0.66$ ,  $\frac{3}{5} = 0.60$ ,  $0.62$ ,  $0.59$ ,  $55\% = 0.55$   
 So order is  $55\%$ ,  $0.59$ ,  $\frac{3}{5}$ ,  $0.62$ ,  $66\%$
- $\frac{4}{5} = 0.8$ ,  $\frac{3}{4} = 0.75$ . So  $\frac{4}{5}$  is bigger than  $\frac{3}{4}$   
 or  $\frac{4}{5} = \frac{16}{20}$  and  $\frac{3}{4} = \frac{15}{20}$  so  $16 > 15$
- $\frac{4}{6}$ ,  $\frac{10}{15}$
- $1\frac{1}{2} = 1\frac{8}{16}$ ,  $1\frac{7}{16}$ ,  $1\frac{1}{4} = 1\frac{4}{16}$ ,  $1\frac{3}{8} = 1\frac{6}{16}$   
 So order is  $1\frac{1}{4}$ ,  $1\frac{3}{8}$ ,  $1\frac{7}{16}$ ,  $1\frac{1}{2}$

### Adding and subtracting fractions and mixed numbers

#### Answers to NTTEQ

- $1\frac{1}{4} + 2\frac{3}{5} = 3 + \frac{1}{4} + \frac{3}{5}$   
 $= 3 + \frac{5}{20} + \frac{12}{20}$   
 $= 3\frac{17}{20}$
- $\frac{1}{4} + \frac{2}{3} = \frac{3}{12} + \frac{8}{12}$   
 $= \frac{11}{12}$   
 $1 - \frac{11}{12} = \frac{1}{12}$   
 so  $\frac{1}{12}$  were Guernseys
- $4\frac{3}{16} - 2\frac{1}{2} = 2 + \frac{3}{16} - \frac{1}{2}$   
 $= 2 + \frac{3}{16} - \frac{8}{16}$   
 $= 1 + \frac{16}{16} + \frac{3}{16} - \frac{8}{16}$   
 $= 1\frac{11}{16}$
- $1\frac{7}{16} - 1\frac{1}{4}$  inches  
 $= 1 - 1 + \frac{7}{16} - \frac{4}{16}$  inches  
 $= \frac{3}{16}$  inches
- $\frac{2}{3} + \frac{4}{5} = \frac{10}{15} + \frac{12}{15}$   
 $= \frac{22}{15}$   
 $= 1\frac{7}{15}$
- a**  $\frac{24}{40} + \frac{25}{40} + \frac{28}{40} + \frac{30}{40} = \frac{107}{40}$   
 $= 2\frac{27}{40}$

Answers to MEP

1  $2\frac{3}{8} - 1\frac{1}{2} = 1\frac{3}{8} - \frac{4}{8}$   
 $= \frac{8}{8} + \frac{3}{8} - \frac{4}{8}$   
 $= \frac{7}{8}$

2  $2\frac{1}{4} - \frac{7}{16} = 2 + \frac{4}{16} - \frac{7}{16}$   
 $= 1 + \frac{16}{16} + \frac{4}{16} - \frac{7}{16}$   
 $= 1\frac{13}{16}$  inches left

3  $2 + 4 + \frac{1}{3} + \frac{1}{2} = 6 + \frac{2}{6} + \frac{3}{6}$   
 $= 6\frac{5}{6}$

4  $\frac{19}{8} - \frac{3}{2} = \frac{19}{8} - \frac{12}{8}$   
 $= \frac{7}{8}$

Multiplying and dividing fractions and mixed number

Answers to NTTEQ

1 a  $\frac{3}{5} \times \frac{5}{6} = \frac{1}{1} \times \frac{1}{2}$   
 $= \frac{1}{2}$

b  $\frac{2}{3} \div \frac{4}{5} = \frac{2}{3} \times \frac{5}{4}$   
 $= \frac{1}{3} \times \frac{5}{2}$   
 $= \frac{5}{6}$

Answers to MEP

1  $\frac{8}{5} \times \frac{20}{9} = \frac{8}{1} \times \frac{4}{9}$   
 $= \frac{32}{9}$   
 $= 3\frac{5}{9}$

2  $\frac{2xy}{x+y} = \frac{2 \times \frac{2}{5} \times \frac{2}{7}}{\frac{2}{5} + \frac{2}{7}}$   
 $= \frac{\frac{8}{35}}{\frac{24}{35}}$   
 $= \frac{8}{35} \times \frac{35}{24}$   
 $= \frac{1}{1} \times \frac{1}{3}$   
 $= \frac{1}{3}$

3 a  $\frac{3}{5} \times \frac{4}{9} = \frac{12}{45}$   
 $= \frac{4}{15}$

b  $\frac{3}{10} \div \frac{4}{15} = \frac{3}{10} \times \frac{15}{4}$   
 $= \frac{9}{8}$   
 $= 1\frac{1}{8}$

4 a  $\frac{7}{3} \times \frac{9}{2} = \frac{7}{1} \times \frac{3}{2}$   
 $= \frac{21}{2}$   
 $= 10\frac{1}{2}$

b  $\frac{9}{4} \div \frac{9}{5} = \frac{9}{4} \times \frac{5}{9} = \frac{1}{4} \times \frac{5}{1}$   
 $= \frac{5}{4}$   
 $= 1\frac{1}{4}$

Adding and subtracting decimals

Answers to TTEQ

- 1 100
- 2 491
- 3 21
- 4 879
- 5 2007
- 6 12.2
- 7 12.69
- 8 3.6
- 9 88.8
- 10 21.16

Multiplying and dividing decimals

Answers to TTEQ

- 1 £4.20
- 2 a £8.40                      b £19.60
- 3 £16.75
- 4 a 46p                        b £1.84
- 5 a 25g                        b 960g

Answers to MEP

1  $15.7 - 3.9 \times 2 = 15.7 - 7.8$   
 $= 7.9$

2 a  $178 + 274 = 452$  miles  
b  $274 - 178 = 96$  miles

3 a Amount spent =  $2 \times 2.27 + 4.56$   
 $= 4.54 + 4.56$   
 $= 9.10$   
Change =  $20 - 9.10$   
 $= £10.90$

b  $18 \times 82 = £14.76$

Percentage increase and decrease

Answers to TTEQ

- 1 Selling price including VAT =  $6.95 \times 1.175$   
 $= 8.16625$   
 $= £8.17$
- 2 Sale price =  $0.85 \times 80$   
 $= £68$

## Answers to MEP

- New price =  $0.9 \times 750$   
= £6.75
- Sale price =  $0.8 \times 45$   
= £36
- Low sugar content =  $0.58 \times 260$   
= 150.8 g
- Reduced rent =  $0.95 \times 140$   
= £133

## 3 Mental methods

### Mental strategies

#### Answers to TTEQ

- |   |       |   |     |   |       |
|---|-------|---|-----|---|-------|
| a | 11.18 | b | 7.1 | c | 4.715 |
| a | 25    | b | 121 | c | 4     |
|   | d 9   | e | 64  |   |       |
- |   |     |   |      |   |   |
|---|-----|---|------|---|---|
| a | 640 | b | 20.1 | c | 4 |
|---|-----|---|------|---|---|

### Rounding to a given number of significant figures

#### Answers to TTEQ

- 10
- |   |     |   |     |   |       |
|---|-----|---|-----|---|-------|
| a | 147 | b | 100 | c | 147.0 |
|---|-----|---|-----|---|-------|

## Answers to MEP

- |   |        |   |          |
|---|--------|---|----------|
| a | 129 kg | b | 128.8 kg |
|---|--------|---|----------|
- |   |     |   |      |
|---|-----|---|------|
| a | 600 | b | 2000 |
|---|-----|---|------|

### Mental methods and devising strategies

#### Answers to TTEQ

- Estimate =  $50 \times 20$   
= £1000  
£770.25 is obviously much too little.
- $80 \times 30 = £24$
- $\frac{3000}{300} = 10$

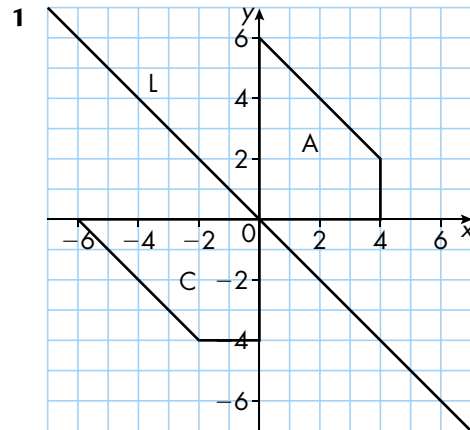
## Answers to MEP

- Estimate =  $24 + 6 \times 3$   
=  $24 + 18$   
= £42  
£45 will be plenty.
- $70 \times 200 = 14\,000$
- 5% is only a small percentage yet his salary has increased by a large amount.
- Estimate =  $\frac{6000}{60 \times 20} = 5$   
So answer of 1917.7 is obviously wrong.

## 4 Transformations

### Reflections

#### Answers to TTEQ



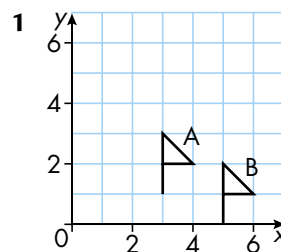
### Rotations

#### Answer to TTEQ

- Rotation through  $90^\circ$  anticlockwise about (3, 0)

### Translations

#### Answer to TTEQ



### Enlargements

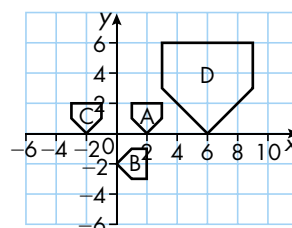
#### Answers to TTEQ

- |   |   |   |        |
|---|---|---|--------|
| a | 2 | b | (2, 2) |
|---|---|---|--------|
- Enlargement centre  $(-1, 2)$ , scale factor 2

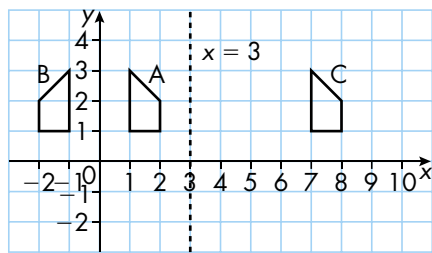
### Combining transformations

#### Answers to NTTEQ

- |         |  |
|---------|--|
| a       | Rotation through $90^\circ$ clockwise about (0, 0) |
| b and c |  |

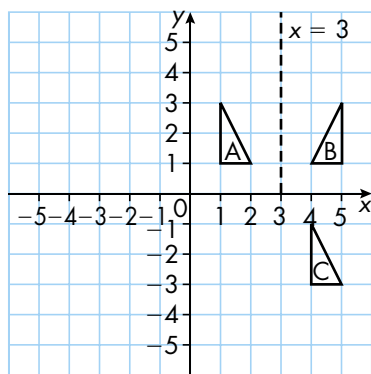


2 a and b



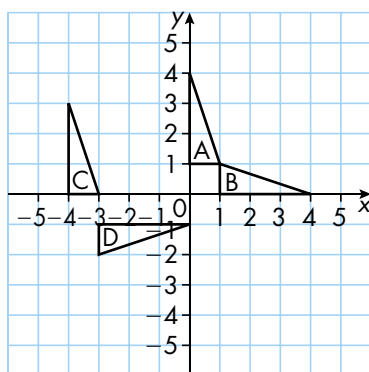
c  $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$

3



4 a Reflection in the line  $y = x$

b



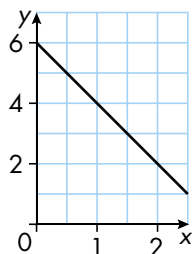
## 5 Straight-line graphs

### Drawing straight-line graphs and harder straight-line graphs

#### Answer to TTEQ

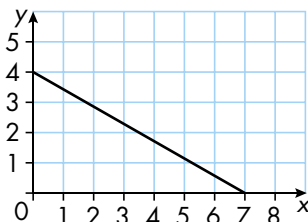
1

<b>x</b>	0	1	2
<b>y</b>	6	4	2



2

<b>x</b>	0	7
<b>y</b>	4	0

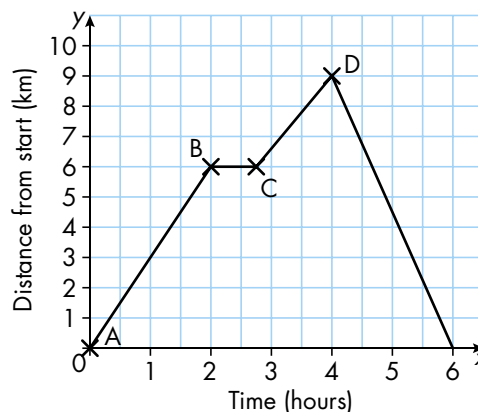


## Distance–time graphs

### Answer to NTTEQ

1 a 4.5 km      b He had stopped

c



d  $9 \div 2 = 4.5 \text{ km/h}$

### Finding the gradient and equation of a straight-line graph

#### Answers to NTTEQ

1 Gradient  $= \frac{-5}{2} = -2.5$

2 a Gradient,  $m = -2$ ,  $y$ -intercept,  $c = 4$

b  $m = -2$ ,  $c = -1$   
So  $y = -2x - 1$

3 a  $m = \frac{1}{2}$ ,  $c = 3$

b  $y = \frac{5}{2} - \frac{3}{2}x$        $m = -1\frac{1}{2}$ ,  $c = 2\frac{1}{2}$

c  $3y = 12 - 4x$   
 $y = \frac{12}{3} - \frac{4}{3}x$        $m = -1\frac{1}{3}$ ,  $c = 4$

### Exploring gradients

#### Answer to TTEQ

1  $y = -x + 1$  so  $m = -1$

Parallel to  $x + y = 1$ :

gradient  $m = -1$

$y = -x + c$

since line goes through (1, 1)

$1 = -1 + c$

$c = 2$

so line is  $y = -x + 2$

Perpendicular to  $x + y = 1$ :

gradient  $m = \frac{-1}{-1} = 1$

$y = x + c$

since line goes through (1, 1)

$1 = 1 + c$

$c = 0$

so line is  $y = x$

## 6 Indices, decimals and surds

The rules of indices and Using the rules of indices with numbers and letters

### Answers to NTTEQ

- 1 a  $3 \times 4 \times a^{2+1} \times b^{1+3} = 12a^3b^4$   
 b  $a^{3-2}b^{5-3} = ab^2$   
 2  $\frac{m^{3+4} \times n^{3+2}}{m^5n} = \frac{m^7n^5}{m^5n} = m^{7-5}n^{5-1} = m^2n^4$   
 3  $x^{5+2} = x^7$   
 4  $\frac{p^{2+6}}{p^3} = \frac{p^8}{p^3} = p^{8-3} = p^5$

## Terminating and recurring decimals

### Answers to TTEQ

- 1 a  $x = 0.141\ 414\dots$   
 $100x = 14.141\ 414\dots$   
 $99x = 14$   
 $x = \frac{14}{99}$   
 b i Recurring. Prime factor of 7  
 ii Terminating. Prime factors of 2 and 5  
 iii Recurring. Prime factors of 2 and 3  
 iv Recurring. Prime factor of 3

## Surds

### Answers to TTEQ

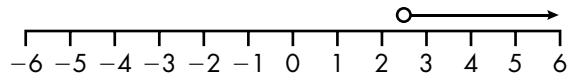
- 1 a i  $\sqrt{36} \times \sqrt{2} = 6\sqrt{2}$   
 ii  $\sqrt{5} \times \sqrt{4} \times \sqrt{5} \times \sqrt{3} = 5 \times 2 \times \sqrt{3}$   
 $= 10\sqrt{3}$   
 iii  $\frac{\sqrt{25}\sqrt{2} \times \sqrt{9}\sqrt{3}}{\sqrt{9}\sqrt{2}} = 5\sqrt{3}$   
 b  $(5 + \sqrt{7})(5 + \sqrt{7}) = 25 + 5\sqrt{7} + 5\sqrt{7} + \sqrt{7}\sqrt{7}$   
 $= 32 + 10\sqrt{7}$   
 $a = 32, b = 10$   
 2 a  $3 + \sqrt{5} + 2 - 3\sqrt{5} = 5 - 2\sqrt{5}$   
 b  $(3 + \sqrt{5})(3 + \sqrt{5}) = 9 + 3\sqrt{5} + 3\sqrt{5} + \sqrt{25}$   
 $= 14 + 6\sqrt{5}$   
 c  $(3 + \sqrt{5})(2 - 3\sqrt{5}) = 6 - 9\sqrt{5} + 2\sqrt{5} - 3\sqrt{25}$   
 $= -9 - 7\sqrt{5}$   
 3 a  $2 + \sqrt{7} + 2 - \sqrt{7} = 4$   
 b  $2 + \sqrt{7} - (2 - \sqrt{7}) = 2 + \sqrt{7} - 2 + \sqrt{7} = 2\sqrt{7}$   
 c  $(2 + \sqrt{7})(2 - \sqrt{7}) = 4 - 2\sqrt{7} + 2\sqrt{7} - \sqrt{49}$   
 $= -3$

## 7 Inequalities

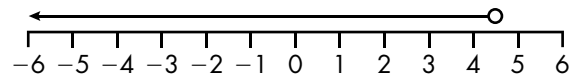
Solving inequalities with one unknown

### Answers to NTTEQ

- 1  $-2, -1, 0, 1, 2, 3, 4$   
 2 a  $8x + 5 > 25$   
 $8x > 25 - 5$   
 $8x > 20$   
 $x > 20 \div 8$   
 $x > 2.5$



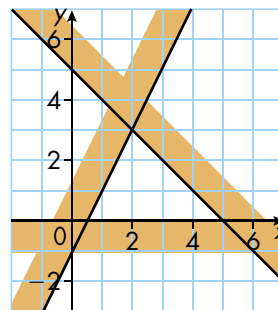
- 6  $2x + 17 > 4x + 6$   
 $17 - 6 > 4x - 2x$   
 $11 > 2x$   
 $4.5 > x$   
 $x < 4.5$



## Solving inequalities with two unknowns

### Answers to NTTEQ

- 1  $y = 0$  is the  $x$ -axis.  
 $x + y = 5$  passes through  $(0, 5)$  and  $(5, 0)$ .  
 $y = 2x - 1$  passes through  $(0, -1)$  and  $(1, 1)$  and  $(2, 3)$ .  
 $y \leq 0$  For  $(0, 1)$ ,  $y \leq 0$  is false.  
 Shade the  $(0, 1)$  (unwanted) side.  
 $x + y \leq 5$  For  $(0, 0)$ ,  $x + y \leq 5$  is true.  
 Shade the opposite (unwanted) side to the origin.  
 $y \leq 2x - 1$  For  $(0, 0)$ ,  $y \leq 2x - 1$  is false.  
 Shade the origin (unwanted) side.



- 2 Choose  $(0, 1)$  in the region.  
 For  $x + y = 3$   $0 + 1 \leq 3$  so  $x + y \leq 3$   
 For  $y = x$   $1 \geq 0$  so  $y \geq x$   
 For  $x = -2$   $0 \geq -2$  so  $x \geq -2$

## 8 Congruency

### Congruent triangles

#### Answer to TTEQ

- 1 In triangle PCX and triangle ARX  
 $PX = RX$  (sides of a square)  
 $CX = AX$  (sides of a square)  
 Angle CXP = angle RXA (both  $90^\circ + \text{angle CXR}$ ).  
 So triangle PCX = triangle RAX (SAS)  
 Therefore angle PCX = angle RAX (corresponding angles).

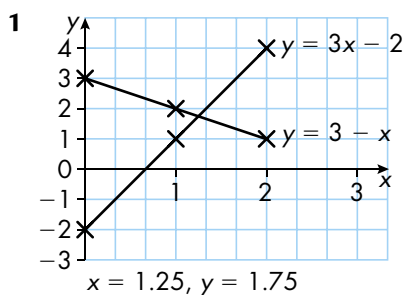
#### Answers to MEP

- 1 In triangle ABC and triangle ECD  
 $BC = CD$  (given)  
 angle ABC = angle EDC (alternate angles)  
 angle ACB = angle DCE (vertically opposite)  
 So triangle ABC = triangle EDC (ASA).
- 2 In triangle ADC and triangle AEB  
 $AC = AB$  (isosceles)  
 $AD = AE$  (half sides of isosceles triangle)  
 angle CAD = angle BAE (common)  
 So triangle ADC = triangle AEB (SAS)  
 therefore  $DC = EB$  (corresponding sides).

## 9 Simultaneous equations

### Solving simultaneous equations graphically

#### Answer to TTEQ

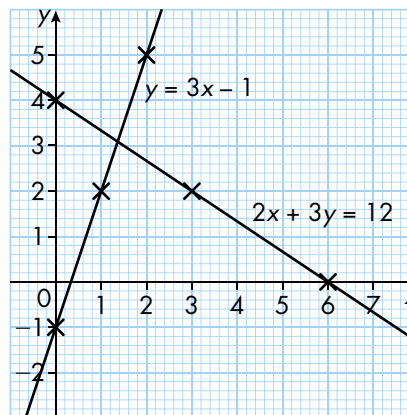


2 a i

<b>x</b>	0	1	2
<b>y</b>	-1	2	5

ii

<b>x</b>	0	3	6
<b>y</b>	4	2	0



b Approx (1.4, 3.1)

### Solving simultaneous equations algebraically

#### Answer to TTEQ

1 a  $5x + 4y = 13$  (1)

$3x + 8y = 5$  (2)

For example, using elimination method

$(1) \times 2 \quad 10x + 8y = 26$  (3)

$(3) - (2) \quad 7x = 21$

$x = 3$

Substitute  $x = 3$  in (1)

$15 + 4y = 13$

$4y = -2$

$y = -0.5$

so  $x = 3, y = -0.5$

b  $4x + 3y = 5$  (1)

$2x + y = 1$  (2)

For example, using substitution method

Rearrange (2)  $y = 1 - 2x$  (3)

Substitute for  $y$  in (1)

$4x + 3(1 - 2x) = 5$

$4x + 3 - 6x = 5$

$-2x = 2$

$x = -1$

Substitute for  $x$  in (3)

$y = 1 - 2 \times (-1)$

$y = 3$

So  $x = -1, y = 3$

c  $y = 3x - 7$  (1)

$2x + 3y = 1$  (2)

For example using substitution method

Substitute for  $y$  in (2)

$2x + 3(3x - 7) = 1$

$2x + 9x - 21 = 1$

$11x = 22$

$x = 2$

Substitute for  $x$  in (1)

$y = 3 \times 2 - 7$

$y = -1$

So  $x = 2, y = -1$

## Solving harder simultaneous equations algebraically

### Answer to TTEQ

- 1 a**  $2x - 3y = 9$   
 $5x + 2y = -25$   
 For example, using elimination method  
 $(1) \times 2$  and  $(2) \times 3$   
 $4x - 6y = 18$   
 $15x + 6y = -75$   
 $(3) + (4)$   
 $19x = -57$   
 $x = -3$   
 Substitute for  $x$  in (1)  
 $2 \times (-3) - 3y = 9$   
 $-6 - 3y = 9$   
 $-3y = 15$   
 $y = -5$   
 So  $x = -3, y = -5$
- b**  $3x - 5y = 11$   
 $4x - 3y = 11$   
 $(1) \times 4$  and  $(2) \times 3$   
 $12x - 20y = 44$   
 $12x - 9y = 33$   
 $(3) - (4)$   
 $-11y = 11$   
 $y = -1$   
 Substitute for  $y$  in (1)  
 $3x - 5 \times (-1) = 11$   
 $3x + 5 = 11$   
 $3x = 6$   
 $x = 2$   
 So  $x = 2, y = -1$

## 10 Vectors

### The definition of a vector

### Answer to TTEQ

- 1 a i**  $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$     **ii**  $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$     **iii**  $\begin{pmatrix} 0 \\ 7 \end{pmatrix}$
- b** It equals  $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$  which shows that the route ABCA starts and ends at A.
- c**  $BC^2 = 3^2 + 5^2 = 34$   
 $BC = \sqrt{34} = 5.83$  units to 2 d.p.

## Multiplying a vector by a scalar

### Answers to TTEQ

- 1 a i**  $2\mathbf{b}$   
**ii**  $-\mathbf{b} + \mathbf{a}$   
**iii**  $\vec{AC} = -\mathbf{a} + 2\mathbf{b}$   
 $\vec{OM} = \vec{OA} + \frac{1}{2}\vec{AC}$   
 $= \mathbf{a} + \frac{1}{2}(-\mathbf{a} + 2\mathbf{b})$   
 $= \frac{1}{2}\mathbf{a} + \mathbf{b}$
- (3)**  $\vec{OH} = \vec{OB} + \vec{BH}$   
 $= \vec{OB} + \frac{1}{3}\vec{BA}$   
 $= \mathbf{b} + \frac{1}{3}(-\mathbf{b} + \mathbf{a})$   
 $= \frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$
- (4)** **b**  $\vec{OH} = \vec{OB} + \vec{BH}$   
 $= \vec{OB} + \frac{1}{3}\vec{BA}$   
 $= \mathbf{b} + \frac{1}{3}(-\mathbf{b} + \mathbf{a})$   
 $= \frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$
- c** Collinear and  $OM = 1.5 \times OH$

## Addition and subtraction of vectors

### Answers TTEQ

- (1)** **1 a** B is  $(-2 + 6, 1 + 5) = (4, 6)$
- (2)** M is  $\left(\frac{-2+4}{2}, \frac{1+6}{2}\right) = (1, 3.5)$
- (3)** N is  $\left(\frac{-2+2}{2}, \frac{1+(-2)}{2}\right) = (0, -0.5)$
- (4)** **b**  $\vec{BC} = \begin{pmatrix} 2-4 \\ -2-6 \end{pmatrix} = \begin{pmatrix} -2 \\ -8 \end{pmatrix}$  or from diagram  
 $\vec{MN} = \begin{pmatrix} 0-1 \\ -0.5-3.5 \end{pmatrix} = \begin{pmatrix} -1 \\ -4 \end{pmatrix}$  or from diagram
- c** MN is parallel to BC and  $BC = 2 \times MN$

## 11 Circle theorems

### Answers to TTEQ

- 1 a**  $\angle ACO = 34^\circ$  (OAC an isosceles triangle)  
 $\angle OCB = 90 - 34 = 56^\circ$  ( $\angle ACB = 90^\circ$ , angle in a semicircle)
- b**  $\angle OBC = 56^\circ$  (OBC an isosceles triangle)  
 $\angle CBT = 180 - 56 = 124^\circ$  (angles on a straight line)
- c**  $\angle BCT = 34^\circ$  ( $\angle OCB = 90^\circ$ ; tangent perpendicular to radius)  
 $\angle CTA = 180 - (124 + 34) = 22^\circ$  (angles in a triangle)
- 2 a**  $a = 90 - 63 = 27^\circ$  (tangent perpendicular to radius)  
 $b = 63^\circ$  (OPQ an isosceles triangle)  
 $c = 180 - (63 + 63) = 54^\circ$  (angles in a triangle)  
 $d = 180 - (90 + 54) = 36^\circ$  (angles in a right-angled triangle)

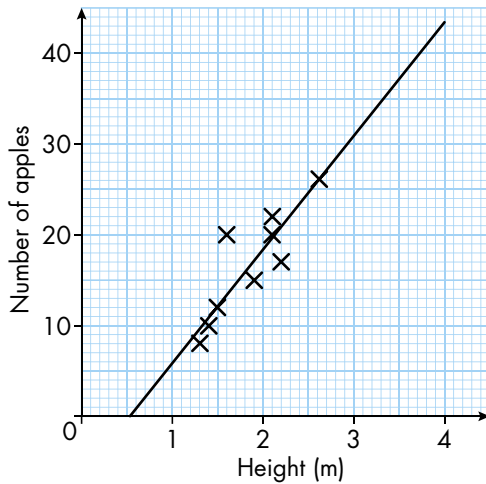
- 3 a**  $x$  (angles in the same segment)  
**b**  $DEA = 90^\circ$  (angle in a semicircle)  
 $DAE = 180 - (90 + x)$  (angles in a triangle)  
 $= 90 - x$   
**c**  $x$  (alternate segment)  
**d**  $2x$  (angle at centre twice angle at circumference)
- 4 a i**  $90^\circ$  (angle in a semicircle)  
**ii**  $53^\circ$  (alternate segment)  
**b**  $AOB = 2x$  (angle at centre is twice angle at circumference)  
 $OAT = OBT = 90^\circ$  (tangent perpendicular to radius)  
 $ATB = 360 - (90 + 90 + 2x)$   
 $= 180 - 2x$  (angles in a quadrilateral equal  $360^\circ$ )

## 12 Scatter diagrams and time series

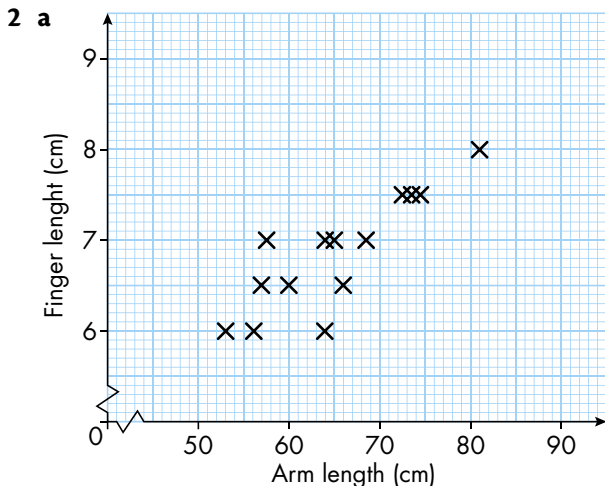
### Scatter diagrams

#### Answers TTEQ

**1 a i and iii**



- ii** Positive correlation  
**iv** 4 m is too far outside the range of the data

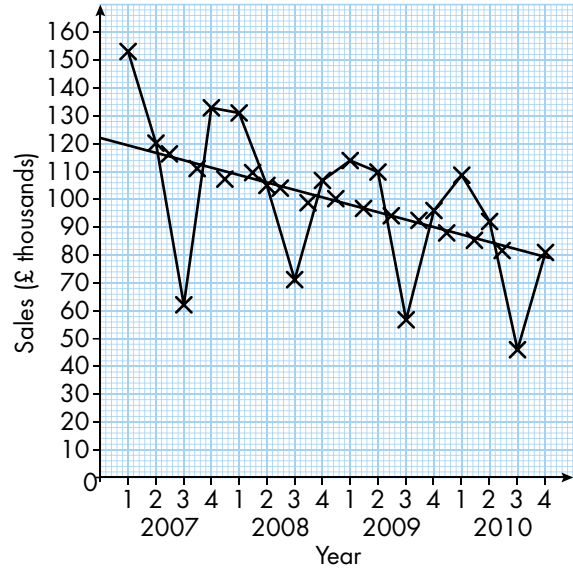


- b** Positive correlation – as arm length increases so does finger length.  
**c** Between 6.8 cm and 7 cm

### Time series

#### Answers to TTEQ

**1 a, c and e**



**b**  $a = \frac{153 + 120 + 62 + 133}{4} = 117$

$b = \frac{120 + 62 + 133 + 131}{4} = 111.5$

- d** General trend: steadily lower  
 Quarterly variation: e.g. highest always 1st quarter, lowest always 3rd quarter

**f** Approx 80.25

**g**  $80.25 = \frac{92 + 46 + 81 + x}{4}$

$x = 4 \times 80.25 - (92 + 46 + 81)$

$x = 102$  So sales predicted to be £102 000



# Answers for Unit C

## 1 Algebraic manipulation

### Answers to NTTEQ

- 1 a  $x^2 + 3x + 7x + 21 = x^2 + 10x + 21$   
 b  $y^2 + 4y - 3y - 12 = y^2 + y - 12$   
 c  $p^2 - 2p - 6p + 12 = p^2 - 8p + 12$   
 2 a  $(3 - x)(3 - x) = 9 - 3x - 3x + x^2 = 9 - 6x + x^2$   
 b  $3x^2 + 12x - 2x - 8 = 3x^2 + 10x - 8$

### Answers to MEP

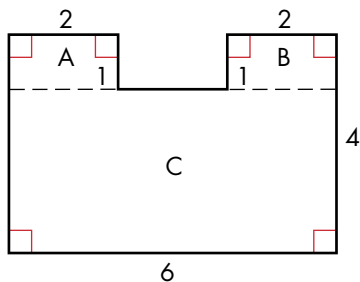
- 1  $2e^2 + 6ef - ef - 3f^2 = 2e^2 + 5ef - 3f^2$   
 2  $a - \sqrt{ab} + \sqrt{ab} - b = a - b$   
 3 a  $(2x + y)(2x + y) = 4x^2 + 2xy + 2xy + y^2$   
 $= 4x^2 + 4xy + y^2$   
 b  $2y^2 - 6y - y + 3 = 2y^2 - 7y + 3$

## 2 Perimeter, area, volume and 2-D representation

### Answers to NTTEQ

- 1 Area of triangle =  $\frac{1}{2} \times \text{base} \times \text{height}$   
 $= \frac{1}{2} \times 4.6 \times 5.0$   
 $= 11.5 \text{ cm}^2$   
 2 Perimeter =  $2 + 1 + 2 + 1 + 2 + 4 + 6 + 4$   
 $= 22 \text{ m}$

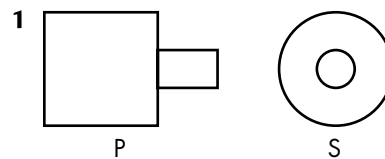
To find the area of the floor, split it into rectangles. Here is one way to do this.



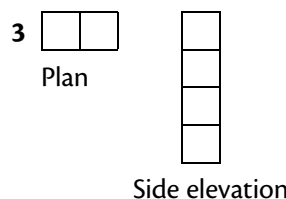
- Area of A =  $2 \times 1$   
 $= 2$   
 Area of B =  $2 \times 1$   
 $= 2$   
 Area of C =  $3 \times 4$   
 $= 12$   
 Total area =  $2 + 2 + 12$   
 $= 16 \text{ m}^2$

- 3 Area of lawn = area of rectangle – area of semicircle with radius 12 m  
 $= 28 \times 24 - \frac{1}{2} \times \pi \times 12^2$   
 $= 445.8 \text{ m}^2$  (to 1 d.p.)  
 4  $C = 2\pi r$   
 $26 = 2 \times \pi \times r$   
 $r = \frac{26}{2 \times \pi}$   
 $= 4.1 \text{ cm}$  (to 1 d.p.)  
 5 Area of shape = area of rectangle + area of triangle  
 $= 6 \times 0.7 + \frac{1}{2} \times 5 \times 4.6$   
 $= 15.7 \text{ cm}^2$   
 6 Volume of prism = area of cross-section  $\times$  length  
 $= 2 \times 2 + 1 \times 1 \times 3$   
 $= 4 + 1 \times 3$   
 $= 5 \times 3$   
 $= 15 \text{ cm}^3$

### Answers to MEP



- 2 a Volume = area of triangle  $\times$  length  
 $= \frac{1}{2} \times 4 \times 3 \times 7$   
 $= 42 \text{ cm}^3$   
 b Surface area =  $2 \times$  area of triangle + area of the three rectangular faces  
 $= 2 \times \frac{1}{2} \times 4 \times 3 + 7 \times 5 + 7 \times 3 + 7 \times 4$   
 $= 12 + 35 + 21 + 28$   
 $= 96 \text{ cm}^2$



- 4 Volume of cuboid = length  $\times$  width  $\times$  height  
 $= 5.2 \times 4.6 \times 1.5$   
 $= 35.88 \text{ m}^3$   
 5 Volume = length  $\times$  width  $\times$  depth  
 $10000 = 50 \times 20 \times d$   
 $10000 = 1000d$   
 $d = 10 \text{ cm}$   
 6 Volume of cylinder =  $\pi r^2 h$   
 $= \pi \times (14 \div 2)^2 \times 7.5$   
 $= \pi \times 7^2 \times 7.5$   
 $= 1154.5 \text{ cm}^3$  (to 1 d.p.)

### 3 Trial and improvement

#### Answers to NTTEQ

1 a Volume =  $4x \times x \times (x + 1) = 200 \text{ cm}^3$   
 $4x^3 + 4x^2 = 200$   
 $x^3 + x^2 = 50$

b

$x$	$x^3 + x^2$		
3	36	too small	
4	80	too big	
3.5	55.125	too big	solution between 3 and 3.5
3.4	50.864	too big	
3.3	46.827	too small	solution between 3.3 and 3.4
3.35	48.818	too small	solution between 3.35 and 3.4
3.36	49.223	too small	
3.37	49.63	too small	
3.38	50.039	too big	solution between 3.37 and 3.38
3.375	49.834	too small	solution between 3.375 and 3.38

So answer is between 3.375 and 3.38 and to 3 s.f. the answer is  $x = 3.38$

2 a To show it has a solution between 2 and 3, try each and show they have different signs.

Try  $x = 2$        $x^3 - 8x + 5 = -3$

Try  $x = 3$        $x^3 - 8x + 5 = 8$

b

$x$	$x^3 - 8x + 5$		
2	-3	too small	
3	8	too big	solution between 2 and 3
2.5	0.625	too big	solution between 2 and 2.5
2.4	-0.376	too small	solution between 2.4 and 2.5
2.45	0.106	too big	solution between 2.4 and 2.45

So answer is between 2.45 and 2.4 and to 1 d.p. the answer is  $x = 2.4$

#### Answers to MEP

1

$x$	$x^3 - 15x + 3$	
3	-15	too small
4	7	too big
3.7	-1.847	too small
3.8	0.872	too big
3.75	-0.5156	too small

So  $x$  is between 3.75 and 3.8 and  $x = 3.8$  to 1 d.p.

2

$x$	$x^3 - 3x$	
2	2	too small
3	18	too big
2.8	13.552	too small
2.9	15.689	too big
2.86	14.814	too small
2.87	15.03	too big
2.865	14.922	too small

So  $x$  is between 2.865 and 2.87 and  $x = 2.87$  to 2 d.p.

3

$x$	$x^3 - 5x - 2$	
2	-4	too small
3	10	too big
2.4	-0.176	too small
2.5	1.125	too big
2.41	-0.0525	too small
2.42	0.07249	too big
2.415	0.00982	too big

So  $x$  is between 2.41 and 2.415 and  $x = 2.41$  to 2 d.p.

4 a

<b>x</b>	1	2	3	4	5	6
<b>V</b>	7	32	81	160	275	432

<b>x</b>	<b>V</b>	
4	100	too small
5	275	too big
4.5	212.6	too big
4.4	201.3	too big
4.3	190.4	too small
4.35	195.8	too small

So  $x$  is between 4.4 and 4.35 and  $x = 4.4$  to 1 d.p.

b The dimensions are 4.4 cm by 4.4 cm by 10.4 cm.

## 4 Probability 1

### Answers to NTTEQ

1  $72 + 15 + 28 + 33 + 12 = 160$

a i  $\frac{72}{160} = \frac{9}{20}$

ii  $\frac{12}{160} = \frac{3}{40}$

iii  $160 - 15 = 145$  so probability is  $\frac{145}{160} = \frac{29}{32}$

b No. People travel for different reasons at different times of the day so the proportions of vehicles will be different.

2 a  $P(\text{Blue}) = 1 - (0.2 + 0.45) = 0.35$

b  $0.45 \times 200 = 90$

### Answers to MEP

1 a  $1 - (0.05 + 0.2 + 0.25 + 0.35) = 1 - 0.85 = 0.15$

b  $1 - 0.25 = 0.75$

c

Colour	Expected number
Orange	$0.05 \times 20 = 1$
White	$0.15 \times 20 = 3$
Yellow	$0.2 \times 20 = 4$
Green	$0.25 \times 20 = 5$
Red	$0.35 \times 20 = 7$

2  $P(3 \text{ spots}) = \frac{420}{1000} = 0.42$

$P(4 \text{ spots}) = 1 - (0.3 + 0.42) = 0.28$

- 3 a H, 1 T, 1  
 H, 2 T, 2  
 H, 3 T, 3  
 H, 4 T, 4  
 H, 5 T, 5

b  $\frac{1}{10}$

## 5 Graphs 1

### Real-life graphs

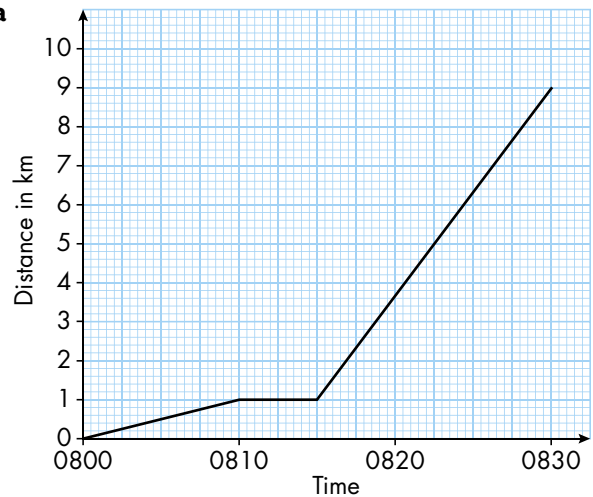
#### Answers to NTTEQ

a Steady speed of 2 m/minute

- b i Runs for 5 minutes then rests for 10 minutes  
 ii 6 m/minute

#### Answers to MEP

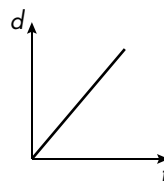
1 a



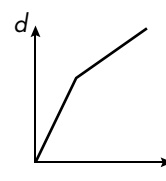
b  $3\frac{2}{3}$  km or 3.7 km

2 e.g. A car accelerates and then travels at a steady speed and then stops suddenly (crashes, etc).

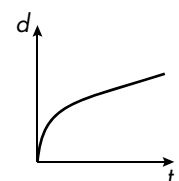
3 a



b



c

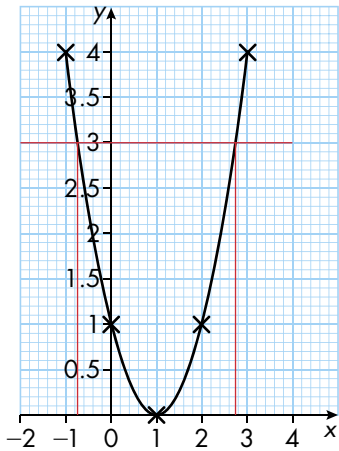


Quadratic graphs

Answers to NTTEQ

1 a

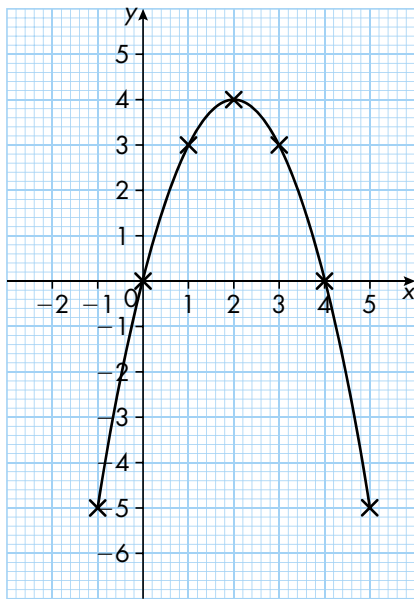
<b>x</b>	-1	0	1	2	3
<b>y</b>	4	1	0	1	4



b  $x = -0.7$  or  $x = 2.7$

2 a

<b>x</b>	-1	0	1	2	3	4	5
<b>y</b>	-5	0	3	4	3	0	-5

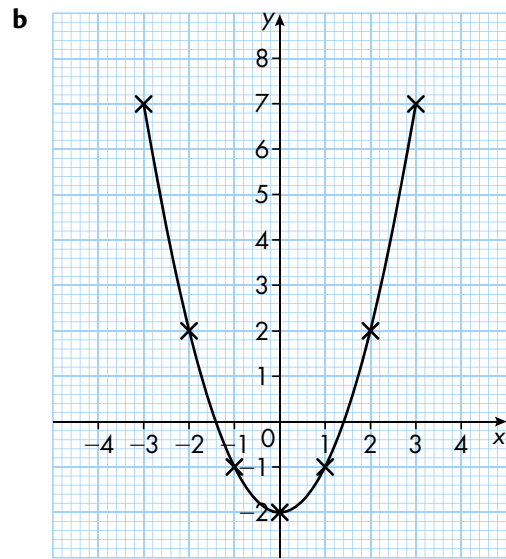


b i  $x = 2$       ii  $x = 0.6$  and  $x = 3.4$

Answers to MEP

1 a

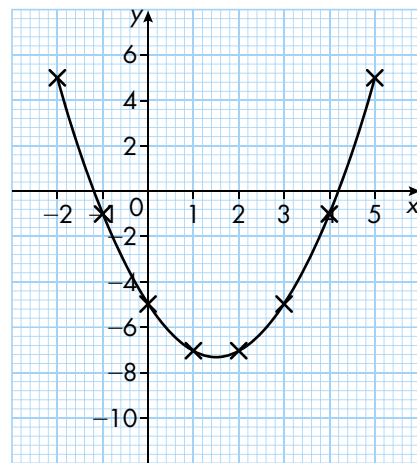
<b>x</b>	-3	-2	-1	0	1	2	3
<b>y</b>	7	2	-1	-2	-1	2	7



c  $x = 1.4$  or  $x = -1.4$

2 a

<b>x</b>	-2	-1	0	1	2	3	4	5
<b>y</b>	5	-1	-5	-7	-7	-5	-1	5



b  $x = -1.2$  or  $x = 4.2$

6 Measures

Compound measures

Answers to NTTEQ

- 1 a i  $22\,656\text{ cm}^2$   
 ii  $2.2656\text{ m}^2$  (or  $2.27\text{ m}^2$  to 2 d.p.)  
 b  $353.5\text{ cm}$  to  $354.5\text{ cm}$  and  $63.5\text{ cm}$  to  $64.5\text{ cm}$   
 2 a  $639.6\text{ cm}^3$       b  $959.4\text{ g}$

## Answers to MEP

- 1 a 16 556 cm (to the nearest cm) or 165.6 m (to 1 d.p.)  
b 9.9 km/h (to 1 d.p.)  
2 128, 129 or 130 people per km<sup>2</sup>

## Bounds of measurements

### Answers to NTTEQ

- 1 For maximum  $a$  need maximum  $(v - u)$  and minimum  $t$   
Max.  $(v - u) = 30.35 - 17.35 = 13$   
Min.  $t = 2.55$   
So maximum  $a = \frac{13}{2.55} = 5.1$  (1 d.p.)

## Answers to MEP

- 1  $600 \times 15 = 9000$  g = 9 kg  
2 Upper bound =  $\frac{2.65 \times 10^7}{5.75 \times 10^5} = 46.1$  people/km<sup>2</sup>  
Lower bound =  $\frac{2.55 \times 10^7}{5.85 \times 10^5} = 43.6$  people/km<sup>2</sup>  
3  $\frac{1.25 \times 10^9}{385\,000} = 3246$  pools

## 7 Percentage and proportional change

### Repeated percentage change

#### Answer to NTTEQ

- 1 Value after 6 months =  $185\,000 \times (1.01)^6$   
= 196 381.2279  
= £196 381

## Answers to MEP

- 1 Amount after 4 years =  $5000 \times 1.04^5$   
= £6083.26  
2 a Value after 1 year =  $899 \times 0.7$   
= £629.30  
b Value after 5 years =  $899 \times 0.7^5$   
= £151.09

### Finding an amount before a percentage increase

#### Answer to NTTEQ

- 1 a  $A \times 0.8 = 10\,240$  so  $10\,240 \div 0.8 = £12\,800$   
b  $10\,240 \div (0.80)^3 = £20\,000$

## Answers to MEP

- 1  $\frac{68}{0.85} = £80$   
2 a  $18\,900 \times 1.04 = £19\,656$   
b  $13\,000 \div 1.04 = £12\,500$   
3 a  $7000 \times 0.9 = £6300$   
b  $4527 \div 0.9 = £5030$

## Increasing or decreasing by a fraction

### Answers to TTEQ

- 1  $£1.52 \times \frac{9}{8} = £1.71$   
2  $4510 \times \frac{3}{5} = 2706$

## Repeated fractional change

### Answers to TTEQ

- 1  $280 \times \left(\frac{13}{12}\right)^5 = £417.80$   
2  $1100 \times \left(\frac{8}{9}\right)^3 = 772$

### Finding an amount before an increase or decrease

#### Answers to NTTEQ

- 1  $115 \div \frac{10}{9} = £103.50$   
2  $\frac{72}{\frac{4}{5}} = £90$

## 8 Standard form and using a calculator

### Standard form

#### Answers to NTTEQ

- 1 a  $(3 \times 6) \times (10^4 \times 10^3) = 18 \times 10^7 = 1.8 \times 10^8$   
b  $1.2 \times 10^8 \div 10^{12} = 1.2 \times 10^{-4}$  terawatts

## Answers to MEP

- 1 a i 1 ii  $\sqrt{9} = 3$   
b  $3 \times 8 \times 10^{-2+5} = 24 \times 10^3 = 2.4 \times 10^4$   
2 a  $2^{8+1-2} = 2^{11}$  b  $2.05 \times 10^3$   
3  $24 \times 10^9 = 2.4 \times 10^{10}$   
4  $35 \times 1.496 \times 10^{11} = 5.236 \times 10^{12}$  m

### The efficient use of a calculator

#### Answers to NTTEQ

- 1 a  $1.897 \times 10^{-5}$  b  $6 \times 10^{-5}$   
2 a  $6.43 \times 10^{10}$  b  $1.13 \times 10^{32}$

### Answers to MEP

- 1 **a**  $7.1 \times 10^7$       **b** 84  
 2  $\cos x = -0.03605\dots$   
 $x = 92.1^\circ$   
 3  $\sin y = 0.25582\dots$   
 $y = 14.8^\circ$   
 4 **a** 8.07      **b** 1.08  
 5 256

## 9 Similarity

### Similar shapes

#### Answers to MEP

- 1 **a** CAD = EDB (corresponding angles)  
 ACE = DEB (corresponding angles)  
 ABC = DBE (same angle)  
 Since equal angles, triangles are similar
- b**  $\frac{AC}{CB} = \frac{DE}{EB}$   
 $\frac{AC}{6} = \frac{1}{2}$   
 $AC = 6 \times \frac{1}{2} = 3 \text{ cm}$
- 2 **a** Angle ADE = angle ABC (corresponding angles,  
 DE parallel to BC)  
 Angle AED = angle ACB (corresponding angles,  
 DE parallel to BC)  
 Angle A is common  
 Triangle are similar as corresponding angles are  
 equal.
- b**  $\frac{AD}{AB} = \frac{1}{4}BC = 4 \times DE = 12 \text{ cm}$

### The area and volume of similar shapes

#### Answer to TTEQ

- 1 **a**  $40 \div 1.25 = 32 \text{ cm}$   
**b**  $32\,000 \times 1.25^3 = 62\,500 \text{ cm}^3$

#### Answers to MEP

- 1 Volume scale factor =  $\frac{100}{50} = 2$   
 Length scale factor =  $\sqrt[3]{2} = 1.26$   
 Height of smaller jug =  $\frac{24}{1.26} = 19 \text{ cm}$
- 2 **a** Length scale factor =  $\frac{24}{16} = 1.5$   
 Area =  $9 \times 1.5^2 = 20.3 \text{ cm}^2$   
**b**  $270 \times 1.5^3 = 911 \text{ g}$

## 10 Factorising

#### Answers to NTTEQ

- 1  $3pq(4p - 5q)$   
 2  $6xy(y - 2x)$   
 3  $3x(2x + 1)$   
 4  $ab(b - 3a)$

#### Answers to MEP

- 1 **a**  $5(x^2 - 4) = 5(x + 2)(x - 2)$   
**b**  $(x - 8)(x - 1)$
- 2  $\frac{x(x+3)}{(x+3)(x-2)} = \frac{x}{x-2}$
- 3  $\frac{(x-3)(x-3)}{(x+3)(x-3)} = \frac{x-3}{x+3}$

## 11 Three-dimensional geometry

#### Answers to TTEQ

- 1 **a** **i** (0, 4, 0)      **ii** (0, 4, 2)  
**iii** (6, 4, 2)      **iv** (6, 2, 0)
- b**  $\sqrt{6^2 + 4^2 + 2^2} = 7.48\dots = 7.5$  (correct to 1 d.p.)
- c**  $\sin^{-1}\left(\frac{2}{7.48\dots}\right) = 15.5^\circ$  (correct to 1 d.p.)

## 12 Proportion and variation

### Direct proportion

#### Answers to TTEQ

- 1 **a** Total parts = 4  
 Multiplier =  $1000 \div 4$   
 $= 250$   
 Blackcurrant = 250 ml
- b** Multiplier = 1.5  
 Total =  $4 \times 1.5$   
 $= 6$  litres
- 2 Paint needed =  $15 \div 60 \times 5$   
 $= 1.25$  litres

### Other types of proportion

#### Answers to NTTEQ

- 1  $R \propto s^2$   
 $R = ks^2$   
 $100 = k300^2$   
 $k = \frac{100}{90000} = \frac{1}{900}$   
 So  $R = \frac{1}{900}s^2$
- a**  $R = \frac{1}{900} \times 600^2 = 400 \text{ N}$

$$\begin{aligned} \text{b } 200 &= \frac{1}{900}s^2 \\ s^2 &= 180\,000 \\ s &= \sqrt{180\,000} \\ s &= 424 \text{ m/s} \end{aligned}$$

$$2 \text{ a } 10 \times 4 = 40 \quad \text{b } 10 \times 4^2 = 160 \quad \text{c } 10 \div 4 = 2.5$$

$$\begin{aligned} 3 \text{ a } y &\propto \frac{1}{x^2} \\ y &= \frac{k}{x^2} \\ 9 &= \frac{k}{2^2} \\ k &= 36 \\ \text{So } y &= \frac{36}{x^2} \end{aligned}$$

$$\begin{aligned} \text{b } 1 &= \frac{36}{x^2} \\ x^2 &= 36 \\ x &= \pm 6 \end{aligned}$$

### Answers to MEP

$$\begin{aligned} 1 \quad y &\propto x^2 \\ y &= kx^2 \\ 75 &= k \times 5^2 \\ \frac{75}{25} &= k \\ k &= 3 \\ \text{So } y &= 3x^2 \\ \text{When } x &= 10, y = 3 \times 10^2 \\ y &= 300 \end{aligned}$$

$$\begin{aligned} 2 \quad N &= \frac{k}{d^2} \\ 8000 &= \frac{k}{2^2} \\ k &= 32\,000 \\ \text{So } N &= \frac{32\,000}{d^2} \\ \text{When } d &= 4, N = \frac{32\,000}{4^2} \\ N &= 2000 \end{aligned}$$

$$\begin{aligned} 3 \quad D &\propto s^2 \\ D &= ks^2 \\ 12.5 &= k \times 50^2 \\ k &= \frac{12.5}{2500} \\ k &= 0.005 \\ \text{So } D &= 0.005s^2 \\ \text{When } s &= 120, D = 0.005 \times 120^2 \\ D &= 72 \text{ m} \end{aligned}$$

$$\begin{aligned} 4 \text{ a } E &\propto s^2 \\ E &= ks^2 \\ 320 &= k \times 8^2 \\ k &= 5 \\ \text{So } E &= 5s^2 \\ \text{When } E &= 720, 720 = 5s^2 \\ s^2 &= \frac{720}{5} \\ s &= \sqrt{144} \\ s &= 12 \text{ metres per second} \end{aligned}$$

**b c**

$$\begin{aligned} 5 \quad T &\propto \sqrt{L} \\ T &= k\sqrt{L} \\ 1.6 &= k\sqrt{64} \\ k &= \frac{1.6}{\sqrt{64}} = \frac{1.6}{8} = 0.2 \end{aligned}$$

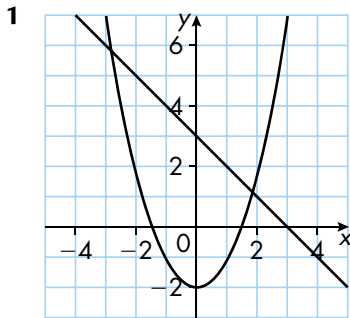
$$\text{So } T = 0.2\sqrt{L}$$

$$\begin{aligned} 6 \quad P &\propto \frac{1}{\sqrt{Q}} \\ P &= \frac{k}{\sqrt{Q}} \\ 12 &= \frac{k}{\sqrt{49}} \\ k &= 12 \times 7 = 84 \\ \text{So } P &= \frac{84}{\sqrt{Q}} \end{aligned}$$

### 13 Graphs 2

#### Solving simultaneous equations graphically

##### Answers to TTEQ

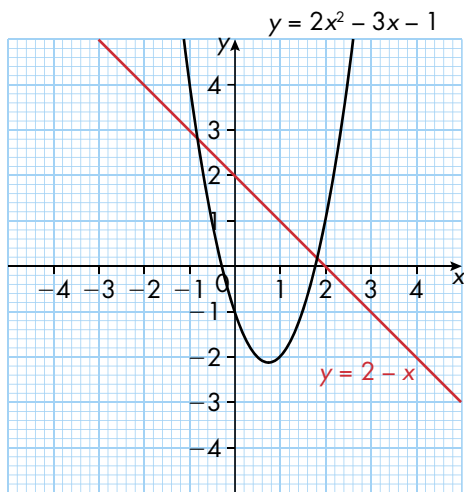


$x = -2.8, y = 5.8$   
or  $x = 1.8, y = 1.2$

#### Using graphs to solve quadratic equations

##### Answers to NTTEQ

a and c



**b i**  $x = -0.3, 1.8$     **ii**  $x = -0.5, 2$   
**c**  $-0.8, 1.8$

### Drawing and recognising other curves

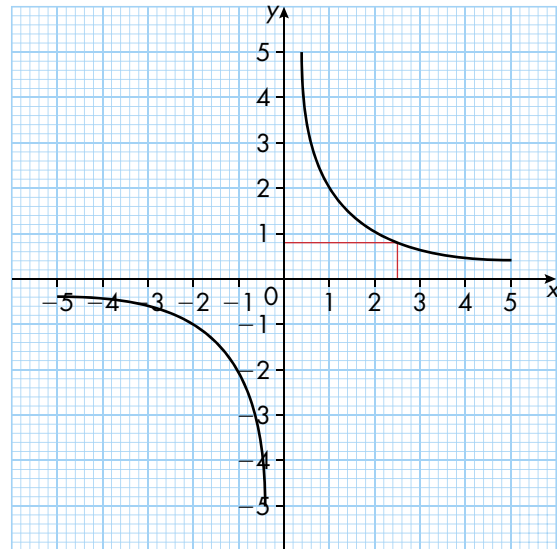
##### Answers to NTTEQ

1 a

<b>x</b>	-5	-4	-3	-2	-1
<b>y</b>	-0.4	-0.5	-0.67	-1	-2

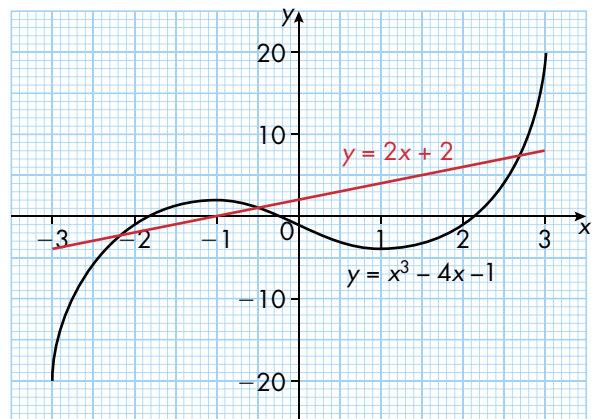
<b>x</b>	1	2	3	4	5
<b>y</b>	2	1	0.67	0.5	0.4



**b**  $x = 2.5$

2 a

<b>x</b>	-3	-2	-1	0	1	2	3
<b>y</b>	-16	-1	2	-1	-4	-1	14



**b**  $x = -2$  to  $-1.7$ ,  $x = -0.4$  to  $-0.2$  or  $x = 2.0$  to  $2.2$

**c**  $x^3 - 6x - 3 = 0$

$x^3 - 4x - 1 - 2x - 2 = 0$

$x^3 - 4x - 1 = 2x + 2$

Draw  $y = 2x + 2$  (see graph in part a)

$x = -2.4$  to  $-2.1$ ,  $x = -0.6$  to  $-0.3$  or  $x = 2.6$  to  $2.8$

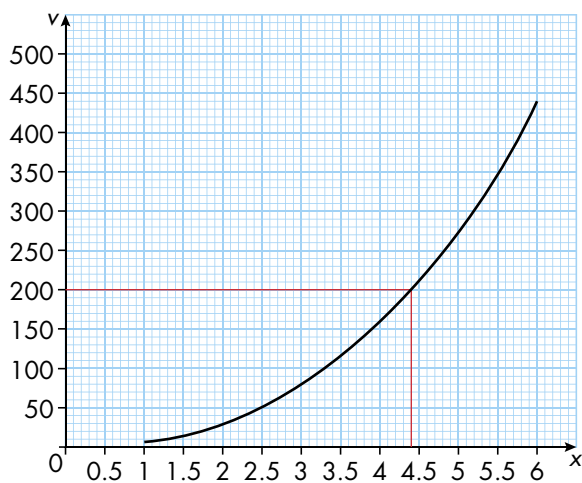


## Answers to MEP

1 a T                      b Q                      c U

2 a

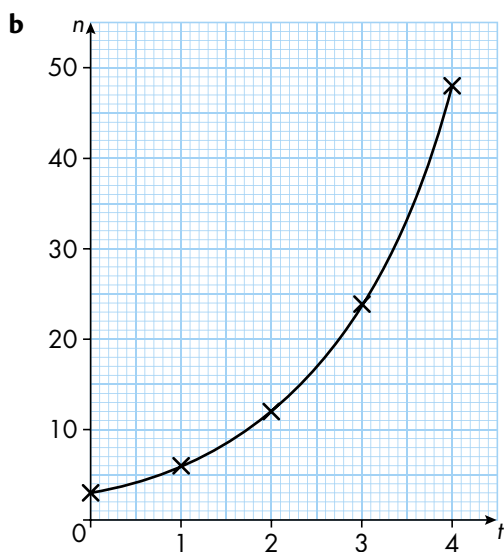
<b>x</b>	1	2	3	4	5	6
<b>y</b>	7	32	81	160	275	432



b 4.4 cm, 4.4 cm, 10.4 cm

3 a

<b>t</b>	0	1	2	3	4
<b>n</b>	3	6	12	24	48



c  $n = 3 \times 2^t$

## 14 Quadratic equations

### Answers to NTTEQ

1 a  $5(x^2 - 4) = 5(x + 2)(x - 2)$

b i  $(x - 8)(x - 1)$

ii  $x = 8$  or  $x = 1$

2  $a = 2$ ,  $b = -38$ ,  $c = 45$

$$x = \frac{-(-38) \pm \sqrt{(-38)^2 - 4 \times 2 \times 45}}{2 \times 2}$$

$$x = \frac{38 \pm \sqrt{1084}}{4}$$

$x = 17.73$  or  $x = 1.27$  to 2 d.p.

3 a  $(x - 6)^2 - 36 + 2 = (x - 6)^2 - 34$

b  $-34$

c  $(x - 6)^2 - 34 = 0$

$$(x - 6)^2 = 34$$

$$x - 6 = \pm\sqrt{34}$$

$$x = 6 \pm\sqrt{34}$$

$x = 11.83$  or  $x = 0.17$  to 2 d.p.

### Answers to MEP

1 a  $(x - 4)(x - 2) = 0$

$x = 2$  or  $x = 4$

b  $(2x - 3)(x + 3) = 0$

$x = 1\frac{1}{2}$  or  $x = -3$

2 a  $6x^2 - 12x + 21x - 42 = 6x^2 + 9x - 42$

b i  $x(x + 6)$

ii  $x(x + 6) = 0$

$x = 0$  or  $x = -6$

3 a Width =  $\frac{30 - 2y}{2} = 15 - y$

$$y(15 - y) = 55$$

$$15y - y^2 = 55$$

$$0 = y^2 - 15y + 55$$

or

$$w = \frac{55}{y}$$

$$2y + 2\left(\frac{55}{y}\right) = 30$$

$$2y^2 + 110 = 30y$$

$$2y^2 - 30y + 110 = 0$$

$$y^2 - 15y + 55 = 0$$

b  $a = 1$ ,  $b = -15$ ,  $c = 55$

$$y = \frac{-(-15) \pm \sqrt{(-15)^2 - 4 \times 1 \times 55}}{2 \times 1}$$

$$y = \frac{15 \pm \sqrt{5}}{2}$$

$y = 8.62$  or  $y = 6.38$  to 2 d.p.

So length = 8.62 cm and width = 6.38 cm

**4 a** Length =  $22 - 2x$   
 $(22 - 2x)x = 60$   
 $22x - 2x^2 = 60$   
 $0 = 2x^2 - 22x + 60$

Divide through by 2  $0 = x^2 - 11x + 30$

or length =  $\frac{60}{x}$

$2x + \frac{60}{x} = 22$

$2x^2 + 60 = 22x$

$2x^2 - 22x + 60 = 0$

$x^2 - 11x + 30 = 0$

**b**  $(x - 6)(x - 5) = 0$

$x = 6$  or  $x = 5$

**c** Dimensions of pen are 6 m by 10 m or 5 m by 12 m.

**5**  $a = 1, b = -4, c = -6$

$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4 \times 1 \times -6}}{2 \times 1}$

$x = \frac{4 \pm \sqrt{40}}{2}$

$x = \frac{4}{2} \pm \frac{2}{2}\sqrt{10}$

$x = 2 \pm \sqrt{10}$

or  $(x - 2)^2 - 4 - 6 = 0$

$(x - 2)^2 = 10$

$x - 2 = \pm\sqrt{10}$

$x = 2 \pm \sqrt{10}$

**6 a**  $x + 3 = \pm 7$

$x = -3 + 7$  or  $x = -3 - 7$

$x = 4$  or  $x = -10$

**b**  $-10 < x < 4$

## 15 Simultaneous equations

### Answers to TTEQ

**1**  $y = x^2 - 4x - 11$  (1) Rearrange (2)  $x + 2y = 8$

$2y = 8 - x$

$y = 4 - \frac{x}{2}$

Substitute for  $y$  in (1)

$4 - \frac{x}{2} = x^2 - 4x - 11$

$8 - x = 2x^2 - 8x - 22$

$0 = 2x^2 - 7x - 30$  (as required)

$0 = (2x + 5)(x - 6)$

$x = 6$  or  $x = -2\frac{1}{2}$

So  $y = 4 - \frac{6}{2} = 1$

or  $y = 4 - \frac{-2\frac{1}{2}}{2} = 5\frac{1}{4}$

Points of intersection are  $(6, 1)$  and  $(-2\frac{1}{2}, 5\frac{1}{4})$

## 16 Trigonometry

### Answers to NTTEQ

**1 a i**  $\sqrt{5^2 + 8^2} = 9.43$  cm

**ii**  $\sqrt{7^2 + 8^2} = 10.63$  cm

**iii**  $\sqrt{5^2 + 7^2} = 8.60$  cm

**b**  $9.43^2 = 10.63^2 + 8.60^2 - 2 \times 10.63 \times 8.60$

$\times \cos ACB$

$\cos ACB = \frac{10.63^2 + 8.60^2 - 9.43^2}{2 \times 10.63 \times 8.60}$

$ACB = 57.6^\circ$  to 1 d.p.

### Answers to MEP

**1 a**  $BC^2 = 10^2 + 8^2 - 2 \times 10 \times 8 - \cos 160^\circ$

$BC = 17.7$  m

**b**  $AP^2 = 8^2 + 4^2$

$AP = 8.94$  m

**2 a**  $AB^2 = 3^2 + 8^2 - 2 \times 3 \times 8 \times \cos 15^\circ$

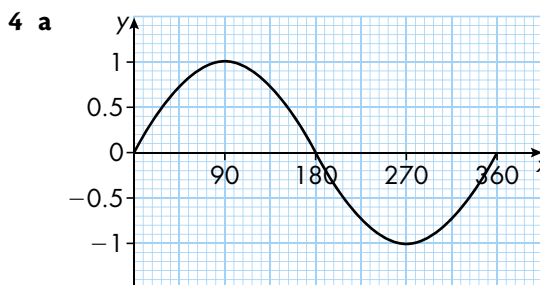
$AB = 5.2$  m

**b**  $\frac{1}{2} \times 3 \times 8 \times \sin 15^\circ = 3.1$  m<sup>2</sup>

**3 a**  $BC^2 = 15^2 + 23^2 - 2 \times 15 \times 23 \times \cos 64^\circ$

$BC = 21.2$  km

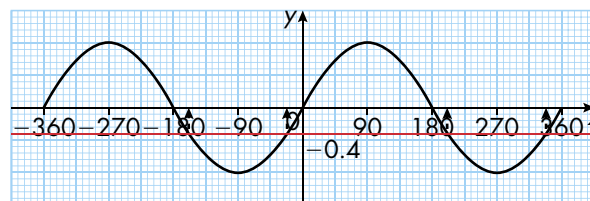
**b**  $\frac{1}{2} \times 15 \times 23 \times \sin 64^\circ = 155$  km<sup>2</sup>



**b**  $\sin 30^\circ = 0.5$  so  $150^\circ$

**c**  $x = \sin^{-1}(-0.4)$

$x = -23.6^\circ$



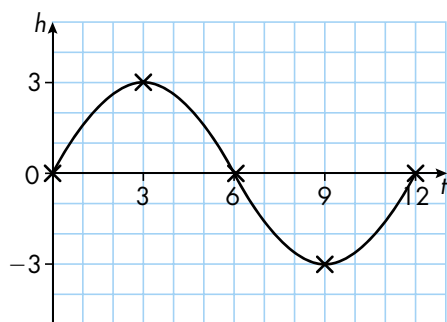
Also  $x = -180 + 23.6 = -156.4^\circ$

$x = 180 + 23.6 = 203.6^\circ$

or  $x = 360 - 23.6 = 336.4^\circ$

5 a

<b>t</b>	0	3	6	9	12
<b>h</b>	0	3	0	-3	0

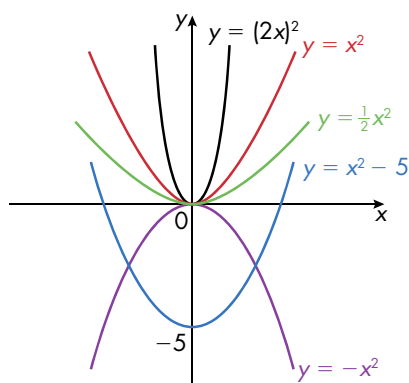


b 2

## 17 Functions

### Answers to NTTEQ

1



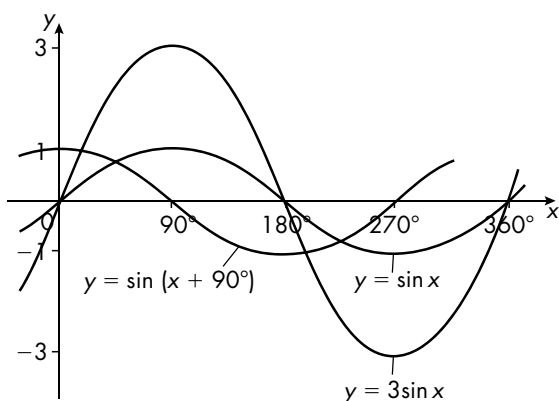
b i Reflection in the  $x$ -axis

ii Translation  $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$

iii One-way stretch parallel to the  $y$ -axis with scale factor  $\frac{1}{2}$

iv One-way stretch parallel to the  $x$ -axis with scale factor  $\frac{1}{2}$

2



### Answers to MEP

1 a Reflection in the  $y$ -axis

b One-way stretch parallel to the  $y$ -axis with scale factor 4

c One-way stretch parallel to the  $x$ -axis with scale factor 2

d Reflection in the  $x$ -axis and a translation of  $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$

or Reflection in  $y = \frac{1}{2}$

2  $y = (x + 1)^2$  and  $y = -x^2 - 2$

3 a  $y = -f(x)$

b  $y = 3f(x)$

c  $y = f(x) + 5$

d  $y = f(x - 1) + 2$

4  $y = \sin 3x$

## 18 Length, area and volume

### Arcs and sectors

#### Answer to NTTEQ

1  $\frac{150}{360} \times 2\pi r = 20$

$$r = \frac{20 \times 360}{150 \times 2 \times \pi}$$

$$r = 7.64 \text{ cm (2 d.p.)}$$

### Answers to MEP

1 a  $\frac{18}{360} \times 2\pi \times 158 + \frac{18}{360} \times 2\pi \times 170 + 12 + 12$   
 $= 127.0 \text{ mm}$

b  $\frac{18}{360} \times \pi \times 170^2 - \frac{18}{360} \times \pi \times 158^2 = 618.3 \text{ mm}^2$

2 a  $\frac{3}{4}(\pi \times 28^2 - \pi \times 22^2) = 706.9 \text{ mm}^2$

b  $\frac{3}{4} \times 2\pi \times 28 + \frac{3}{4} \times 2\pi \times 22 + 6 + 6 = 247.6 \text{ mm}$

3  $\frac{144}{360} \times \pi \times 14.5^2 - \frac{1}{2} \times 14.5 \times 14.5 \times \sin 144^\circ = 202.4 \text{ m}^2$

### Pyramids, cones and spheres

#### Answer to NTTEQ

1  $\frac{1}{3} \times \pi \times 3.5^2 \times 11 + \frac{1}{2}(\frac{4}{3} \times \pi \times 3.5^3) = 230.9 \text{ cm}^3$

### Answers to MEP

1 Base diagonal  $= \sqrt{4^2 + 4^2} = 5.66 \text{ cm}$

$$\text{Height of pyramid} = \sqrt{6^2 - 2.828^2} = 5.29 \text{ cm}$$

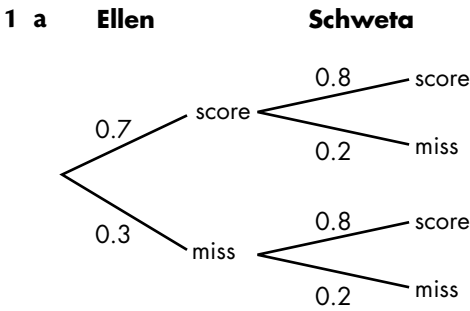
$$\text{Volume} = \frac{1}{3} \times 4^2 \times 5.29 = 28.2 \text{ cm}^3$$

2 a Since similar shapes:  $\frac{R}{4} = \frac{5}{10}$   
 $R = 2 \text{ cm}$

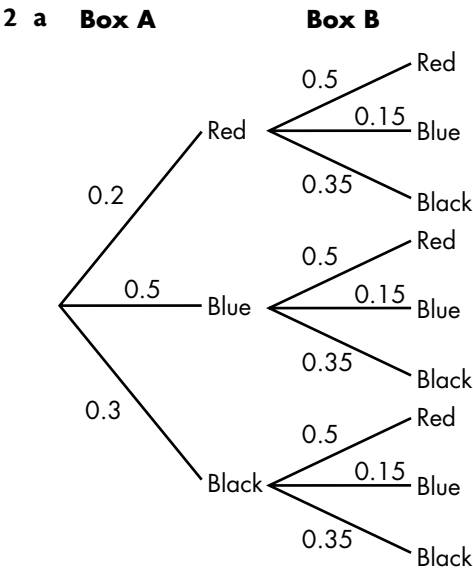
b  $\frac{1}{3}\pi \times 4^2 \times 10 - \frac{1}{3} \times \pi \times 2^2 \times 5 = 147 \text{ cm}^3$

19 Probability 2

Answers to NTTEQ

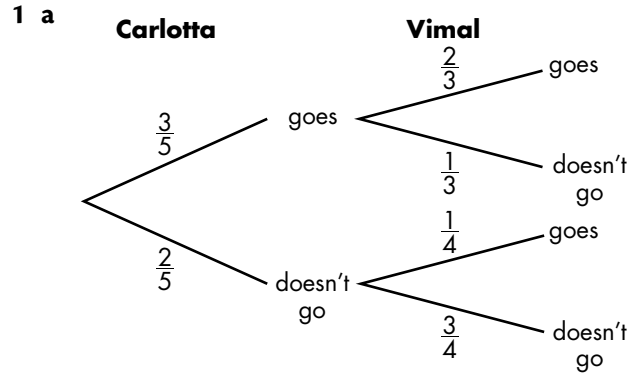


- b i**  $0.7 \times 0.8 = 0.56$   
**ii**  $0.7 \times 0.2 + 0.3 \times 0.8 = 0.14 + 0.24 = 0.38$



- b**  $0.2 \times 0.5 = 0.1$  or 10%  
**c**  $0.2 \times 0.5 + 0.5 \times 0.15 + 0.3 \times 0.35 = 0.28$  or 28%  
**3 a**  $\frac{2}{12} = \frac{1}{6}$   
**b**  $\frac{5}{30} \times \frac{4}{29} = \frac{2}{87}$   
**c** RRL + RLR + LRR  
 $\frac{10}{12} \times \frac{9}{11} \times \frac{2}{10} + \frac{10}{12} \times \frac{2}{11} \times \frac{9}{10} + \frac{2}{12} \times \frac{10}{11} \times \frac{9}{10} = \frac{3}{22} \times 3 = \frac{9}{22}$

Answers to MEP



- b i**  $\frac{3}{5} \times \frac{2}{3} = \frac{2}{5}$     **ii**  $\frac{2}{5} \times \frac{3}{4} = \frac{3}{10}$   
**2 a**  $\frac{6}{15} \times \frac{5}{14} = \frac{1}{7}$   
**b**  $\frac{6}{15} \times \frac{5}{14} + \frac{4}{15} \times \frac{3}{14} + \frac{5}{15} \times \frac{4}{14} = \frac{31}{105}$   
**c** RW + WR + RB + BR + BW + WB  
 $2 \times \frac{4}{15} \times \frac{5}{14} + 2 \times \frac{4}{15} \times \frac{6}{14} + 2 \times \frac{6}{15} \times \frac{5}{14} = \frac{74}{105}$   
**3 a**  $\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$   
**b i**  $\left(\frac{5}{6}\right)^n$     **ii**  $1 - P(\text{no sixes}) = 1 - \left(\frac{5}{6}\right)^n$   
**4** DEE + EDE + EED  
 $\frac{2}{9} \times \frac{3}{8} \times \frac{2}{7} + \frac{3}{9} \times \frac{2}{8} \times \frac{2}{7} + \frac{3}{9} \times \frac{2}{8} \times \frac{2}{7} = \frac{1}{14}$

20 Algebraic fractions

Answers to NTTEQ

- 1** Multiply through by  $(x+1)(3x+1)$   
 $12(x+1) - 5(3x+1) = (x+1)(3x+1)$   
 $12x + 12 - 15x - 5 = 3x^2 + 4x + 1$   
 $0 = 3x^2 + 7x - 6$   
 $(3x-2)(x+3) = 0$   
 $x = \frac{2}{3}$  or  $x = -3$   
**2 a**  $\frac{2x - (x-3)}{x(x-3)} = \frac{2x - x + 3}{x(x-3)}$   
 $= \frac{x+3}{x(x-3)}$   
**b**  $\frac{2(x-2) + 3(x+1)}{(x+1)(x-2)} = \frac{2x-4+3x+3}{(x+1)(x-2)}$   
 $= \frac{5x-1}{(x+1)(x-2)}$

**3 a**  $\frac{48}{12} = 4$  hours

**b** Return time =  $\frac{48}{8} = 6$  hrs

so average speed =  $\frac{48 + 48}{6 + 4} = \frac{96}{10} = 9.6$  km/h

**c i**  $\frac{48}{x} + \frac{48}{x-5} = 8$

Divide through by 8:  $\frac{6}{x} + \frac{6}{x-5} = 1$

**ii** Multiply through by  $x(x-5)$

$$6(x-5) + 6x = x(x-5)$$

$$6x - 30 + 6x = x^2 - 5x$$

$$0 = x^2 - 17x + 30$$

$$(x-2)(x-15) = 0$$

$$x = 2 \text{ or } x = 15$$

**iii** But  $x \neq 2$  otherwise return journey speed would be negative so  $x = 15$  km/h; so average speed for return journey =  $15 - 5 = 10$  km/h

## Answers to MEP

**1 a**  $(2x-3)(x+4) = 3(x+1)$

$$2x^2 + 8x - 3x - 12 = 3x + 3$$

$$2x^2 + 2x - 15 = 0$$

**b**  $a = 2, b = 2, c = -15$

$$x = \frac{-2 \pm \sqrt{2^2 - 4 \times 2 \times -15}}{2 \times 2}$$

$$x = \frac{-2 \pm \sqrt{124}}{4}$$

$$x = 2.28 \text{ or } x = -3.28$$

$$x(x+3)$$

**2**  $\frac{n+2}{n} = \frac{n}{n+2} = \frac{(n+2)(n+2) - n \times n}{n(n+2)}$

$$= \frac{n^2 + 4n + 4 - n^2}{n(n+2)}$$

$$= \frac{4n + 4}{n(n+2)} = \frac{4(n+1)}{n(n+2)}$$