Answers

Chapter 1: Number review

Starter 1

1 97 542 **2** 24 579

3 **a)** **(i)** $9 + 7 = 16$ **(ii)** $2 + 4 = 6$

b) **(i)** $95 + 74 = 169$ or $94 + 75 = 169$

(ii) $25 + 47 = 72$ or $27 + 45 = 72$

c) **(i)** $974 + 52 = 1026$ or $954 + 72 = 1026$ or $972 + 54 = 1026$ or $952 + 74 = 1026$

(ii) $247 + 59 = 306$ or $259 + 47 = 306$ or $259 + 47 = 306$ or $257 + 49 = 306$

d) **(i)** $9 - 2 = 7$

(ii) $5 - 4 = 1$ or $2 - 9 = 7$

e) **(i)** $97 - 24 = 73$

(ii) $52 - 49 = 3$ or $24 - 97 = -73$

f) **(i)** $9 \times 7 = 63$ **(ii)** $2 \times 4 = 8$

g) **(i)** $75 \times 9 = 675$ **(ii)** $45 \times 2 = 90$

h) **(i)** $94 \times 75 = 7050$ **(ii)** $47 \times 25 = 1175$

i) **(i)** $752 \times 94 = 70\,688$ **(ii)** $259 \times 47 = 12\,173$

4 Class discussion

Exercise 1.1

1 **a)** four hundred and seventy-two

b) three thousand, seven hundred and forty

c) two million, three hundred and forty-five thousand

d) forty thousand, five hundred and seven

2 **a)** 608 **b)** 9026 **c)** 4 500 000

d) 1210 **e)** 6500 **f)** 200 940

3 **a)** 6, 60, 100, 106, 160, 600

b) 234, 243, 324, 342, 423, 432

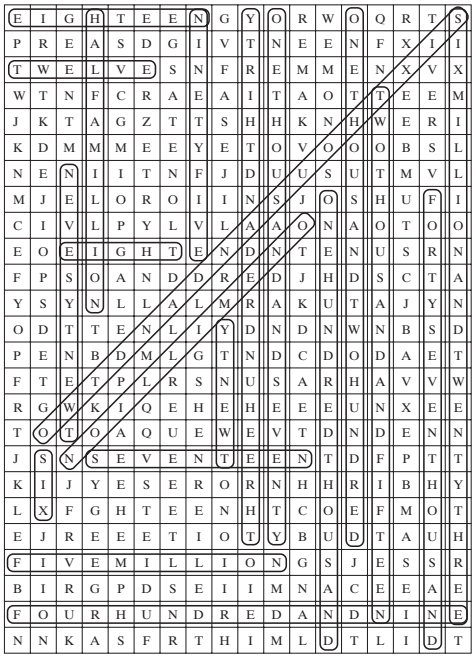
c) 3000, 3400, 4000, 4030, 4040, 4300

d) 50 028, 50 820, 52 800, 58 002, 58 200

e) 500 910, 510 900, 519 000, 590 100, 591 000

f) 37 924, 39 742, 72 943, 73 492, 74 932

Worksheet 1.1



Exercise 1.2

1 **a)** 59 **b)** 165 **c)** 122

d) 333 **e)** 520 **f)** 1087

2 £22 **3** 55 **4** 656

5 821 **6** 81

7 **a)** 73 **b)** 58 **c)** 22

d) 46 **e)** 81 **f)** 37

Worksheet 1.2/1.3

(A)

1 8		2 6	3 3
4 5	5 7		8
	6 3	7 2	1
8 4	0	9	

(B)

1 2	2 3		3 1	4 5	5 7
	6 6	4		7 9	2
8 8	0		9 1	0	
			5		2

Exercise 1.3

1 **a)** 32 **b)** 211 **c)** 26

d) 359 **e)** 56 **f)** 387

2 244 **3** 33 **4** 568

5 **a)** 1565 **b)** 364 **c)** 5375

d) 1201 **e)** 20 846

Exercise 1.4

×	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

2 **a)** 15 **b)** 28 **c)** 56 **d)** 54

e) 49 **f)** 64 **g)** 81 **h)** 48

i) 42 **j)** 72 **k)** 60 **l)** 72

3 **a)** 8 **b)** 6 **c)** 9 **d)** 7

e) 7 **f)** 9 **g)** 5 **h)** 2

i) 6

Worksheet 1.4

(A)

1 4	9	
2		2 6
	3 2	4

(B)

1 5	2 4		
	3 8	4 1	
			6

(C)

	1 1	2 2
3 3		8
4 5	0	

Exercise 1.5

1 **a)** 90 **b)** 230 **c)** 510 **d)** 3240
e) 7 **f)** 18.9 **g)** 63 **h)** 6.1
2 **a)** 700 **b)** 3600 **c)** 4700 **d)** 51 200
e) 431 **f)** 260 **g)** 10 **h)** 1
3 **a)** 4000 **b)** 72 000 **c)** 123 000 **d)** 500 000
e) 15 100 **f)** 20 **g)** 4321 **h)** 5
4 **a)** 100 **b)** 280 **c)** 210 **d)** 1600
e) 1200 **f)** 3200 **g)** 6000 **h)** 7200
i) 600 **j)** 3000 **k)** 12 000 **l)** 1000

Worksheet 1.5

Section A

1 460 **2** 8300 **3** 92 000
4 7000 **5** 1290 **6** 81 000
7 3900 **8** 5000 **9** 9050
10 8000 **11** 6800 **12** 5000

Section B

1 83 **2** 964.1 **3** 8700
4 20.14 **5** 389.1 **6** 380
7 1364 **8** 39.03 **9** 285 600
10 1005 **11** 87.3 **12** 5.11

Section C

1 1530 **2** 24 600 **3** 460
4 27 600 **5** 8600 **6** 2880
7 15 300 **8** 3450 **9** 18 400
10 1680

Exercise 1.6

1 **a)** 3 **b)** 24 **c)** 320 **d)** 50 000
e) 2.4 **f)** 5.9 **g)** 0.27 **h)** 0.036
2 **a)** 40 **b)** 5 **c)** 660 **d)** 10 000
e) 0.44 **f)** 0.21 **g)** 0.032 9 **h)** 0.003 45
3 **a)** 5 **b)** 12 **c)** 340 **d)** 2000
e) 0.6 **f)** 0.05 **g)** 0.034 **h)** 0.006 7
4 **a)** 50 **b)** 4 **c)** 7
d) 30 **e)** 70 **f)** 240
g) 2 **h)** 90 **i)** 9

Worksheet 1.6

Section A

1 850 **2** 98 **3** 63
4 810 **5** 65 **6** 8900

Section B1

1 6.583 **2** 0.986 **3** 0.087
4 0.0712 **5** 0.721 **6** 0.9874

Section B2

1 34 500 **2** 6780 **3** 9.87
4 0.1027 **5** 567 **6** 8100
7 670 **8** 456 **9** 0.51
10 0.9625 **11** 12 100 **12** 0.065
13 23 000 **14** 980 200

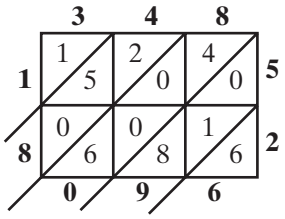
Section C

1 4370 **2** 3090 **3** 12 540
4 1982 **5** 71 **6** 30 900
7 210 **8** 1254 **9** 1110
10 437

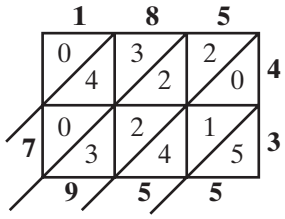
Exercise 1.7

1 **a)** 1035 **b)** 578 **c)** 720
d) 6278 **e)** 1976 **f)** 5688
g) 1476 **h)** 14 628 **i)** 6912
2 £65 025
3 **a)** 672 **b)** £12 096

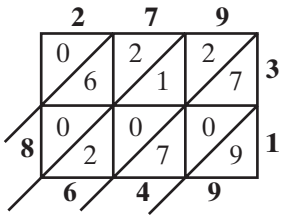
Worksheet 1.7



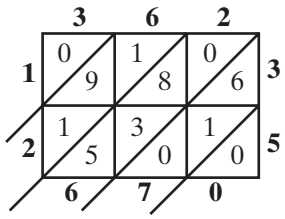
Answer:
348 × 52 = 18 096



Answer:
185 × 43 = 7955



Answer:
279 × 31 = 8649



Answer:
362 × 35 = 12 670

Exercise 1.8

1 **a)** 72 **b)** 85 **c)** 17
d) 24 **e)** 16 **f)** 37
g) 14 **h)** 8 **i)** 17
2 **a)** 9 rem. 3 **b)** 8 rem. 5 **c)** 22 rem. 2
d) 17 rem. 4 **e)** 48 rem. 3 **f)** 22 rem. 3
3 24
4 18

Exercise 1.9

1 £49 **2** £23 **3** £17.55
4 **a)** 900p **b)** 34
5 24 **6** £420

Worksheet 1.9

1 2 kg apples = 3.12
3 kg oranges = 2.88
1 kg mushrooms = 2.13
Total = £8.13
Change from £10 = £1.87
2 3 kg onions = 2.46
2 kg grapes = 4.68
2 kg carrots = 1.34
Total = £8.48
Change from £10 = £1.52
3 4 kg potatoes = 2.92
1 kg beans = 1.24
2 kg pears = 3.50
Total = £7.66
Change from £10 = £2.34
4 1 kg mushrooms = 2.13
5 kg bananas = 4.25
4 kg onions = 3.28
Total = £9.66
Change from £10 = £0.34

Exercise 1.10

1 **a)** 7 **b)** 3 **c)** 5
d) −2 **e)** 2 **f)** −7
2 **a)** 4 **b)** −5 **c)** −9
d) 7 **e)** 9 **f)** 2
3 **a)** −1 **b)** −2 **c)** −9
d) −10 **e)** 0 **f)** −10
4 **a)** −4, −3, −2, 0, 2, 4
b) −5, −2, −1, 2, 3, 4
c) −7, −6, −4, −1, 2, 3
d) −8, −6, −4, −3, −2, −1
5 **a)** **(i)** 7 °C **(ii)** −10 °C
b) **(i)** 6 °C **(ii)** 8 °C
c) −7 °C
6 −£14 (owes £14)
7 **a)** 36 feet **b)** 25 feet **c)** 53 feet **d)** 79 feet

Worksheet 1.10/1.11

The coded message is:
I AM GREAT AT NEGATIVE NUMBERS

Exercise 1.11

1 −42	**2** 44	**3** −60	**4** 9
5 −20	**6** −60	**7** −6	**8** 36
9 −13	**10** 54	**11** −56	**12** −132
13 7	**14** −7	**15** 63	**16** −8
17 −7	**18** 1	**19** −4	**20** 9
21 4	**22** −11	**23** −1	**24** 0
25 −6	**26** −2	**27** −8	

Exercise 1.12

1 **a)** 20	**b)** 190	**c)** 400	**d)** 220
2 **a)** 100	**b)** 200	**c)** 300	**d)** 2000
3 **a)** 1000	**b)** 1000	**c)** 3000	**d)** 9000
4 **a)** 3	**b)** 17	**c)** 9	**d)** 10
5 **a)** 40	**b)** 20	**c)** 200	**d)** 400
e) 1000	**f)** 800	**g)** 2000	**h)** 6000
6 **a)** 650	**b)** 730	**c)** 480	**d)** 370
e) 4600	**f)** 6800	**g)** 2800	**h)** 8300

Worksheet 1.12

1 9.84	**2** 62 000
3 80	**4** 39
5 60	**6** 3.65
7 6000	**8** 7830
9 0.038	**10** 70 000
11 6000	**12** 4.03
13 40	**14** 6700
15 8960	**16** 17 000
17 5.64	**18** 50
19 789.2	**20** 700
21 1000	**22** 9100
23 80	**24** 92.46
25 40 000	**26** 178
27 40 000	**28** 20 400

Exercise 1.13

1 **a)** 1000 **b)** 1000 **c)** 20
d) 6 **e)** 8 **f)** 20
g) 4 **h)** 5 **i)** 6
2 **a)** 2400
b) £14 400 or £12 000

Review Exercise 1

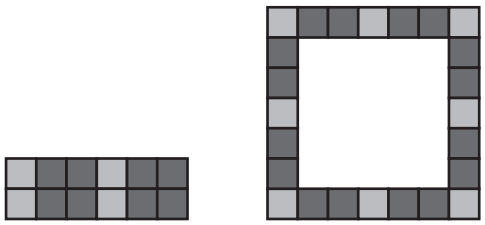
1 **a)** 415 **b)** 1187 **c)** 442 **d)** 3672
2 **a)** 288 **b)** 42 **c)** 2964 **d)** 1888
3 **a)** 578 **b)** 4134 **c)** 2250
d) 2451 **e)** 20 230 **f)** 2368
4 **a)** 13 **b)** 27 **c)** 27
d) 32 **e)** 15 **f)** 12
5 **a)** 300 594 **b)** 7860 **c)** 13 808 **d)** 600
6 **a)** 17, 83, 91, 109, 140 **b)** −8, −4, −2, 1, 4
7 **a)** 17 252 **b)** 5400 **c)** 4000
8 £520 **9** 57 **10** £61
11 **a)** 396 **b)** 187 **c)** 891 **d)** 748
12 **a)** 330 **b)** 200 **c)** 5
13 20
14 140
15 **a)** **(i)** 1459 **(ii)** 9541
b) 9 + 5 = 14
c) 0
16 **a)** 54 000 **b)** 50 000
17 **a)** 10 °C **b)** 10 °C
c) July **d)** −11 °C
18 **a)** 90 °C **b)** 540 °C
c) Jupiter **d)** −230 °C

Chapter 2: Ratio and proportions

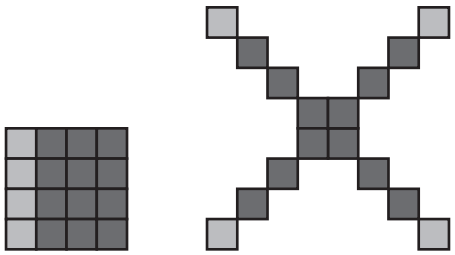
Starter 2

The diagrams below show one way of shading each shape – there are many other possibilities.

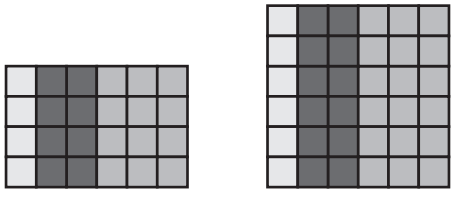
1



2



3

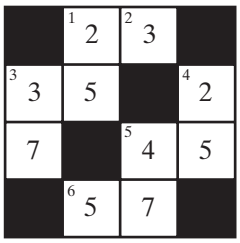


Exercise 2.1

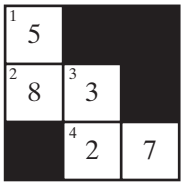
1 **a)** 1 : 2 **b)** 2 : 3 **c)** 7 : 5 **d)** 2 : 3
e) 2 : 1 **f)** 3 : 4 **g)** 1 : 3 **h)** 3 : 1
2 **a)** 2 : 4 **b)** 10 : 15 **c)** 10 : 14
d) 16 : 18 **e)** 25 : 40 **f)** 32 : 40
3 2 : 3 = 6 : 9 = 12 : 18
1 : 3 = 2 : 6 = 4 : 12 = 6 : 18
3 : 2 = 12 : 8

Worksheet 2.1

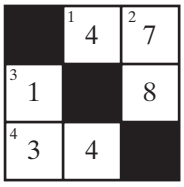
1



2



3



Exercise 2.2

1 **a)** £80 and £160 **b)** £90 and £150
c) £40, £80 and £120 **d)** £60, £80 and £100
2 **a)** £60 and £300 **b)** £160 and £200
c) £40, 120 and £200 **d)** £30, £120 and £210
3 24 **4** 15
5 **a)** 2 litres **b)** 4 litres **c)** 10 litres
6 165 **7** Magda £70, Janek £56

Exercise 2.3

1 £37.50
2 **a)** 75p **b)** £3
3 **a)** **(i)** 60 g butter **(ii)** 50 g sugar
(iii) 100 g oats
b) **(i)** 30 g butter **(ii)** 25 g sugar
(iii) 50 g oats
c) **(i)** 150 g butter **(ii)** 125 g sugar
(iii) 250 g oats
4 **a)** A$2700 **b)** £40 **c)** Britain; £4
5 The 30 g bag
6 **a)** 165 calories **b)** 500 calories
7 **a)** 759 euros **b)** £220
8 **a)** 225 g pastry, 105 g butter, 120 g sugar, 75 g almonds, 375 g blackberries
b) 750 g pastry, 350 g butter, 400 g sugar, 250 g almonds, 1250 g blackberries

Exercise 2.4

1 **a)** **(i)** 12 cm by 10 cm
(ii) 10 cm by 8 cm
(iii) 6 cm by 7 cm
b) **(i)** 3 m by 2.5 m
(ii) 3.6 m by 4.2 m
(iii) 3.15 m by 2.9 m
2 **a)** 1 : 1200 **b)** 240 m **c)** 250 cm
3 **a)** **(i)** 0.4 km **(ii)** 2 km
(iii) 0.1 km **(iv)** 1.64 km
b) **(i)** 50 cm **(ii)** 30 cm **(iii)** 21 cm

Review Exercise 2

1 **a)** 1 : 2 **b)** 2 : 5 **c)** 3 : 8 **d)** 5 : 12
e) 1 : 3 **f)** 1 : 2 : 5 **g)** 3 : 5 : 7 **h)** 2 : 3 : 8
2 Ingrid £180, Hilmar £240
3 160
4 **a)** 180 **b)** 240 **c)** 300
5 **a)** **(i)** 300 g wheatflakes, 120 g mixed fruit, 50 g mixed nuts, 30 g oatflakes
(ii) 900 g wheatflakes, 360 g mixed fruit, 150 g mixed nuts, 90 g oatflakes
b) **(i)** 1600 calories **(ii)** 4800 calories
6 **a)** 200 g sugar **b)** 600 ml milk
7 **a)** **(i)** 2.3 m by 2.3 m
(ii) 3.1 m by 3.1 m
(iii) 3.1 m by 2.7 m
b) 4.2 cm by 5.1 cm
8 £8.10
9 **a)** 100 ml ketchup, 40 ml brown sauce, 40 ml mustard, 80 ml soy sauce, 20 chicken legs
b) 100
10 **a)** 492 euros **b)** £79.33
11 200 g flour, 150 g almonds, 225 g sugar, 150 g butter, 10 pears
12 £12.60 **13** 82 km **14** 62.5 cm
15 **a)** 945 francs **b)** £30

Chapter 3: Decimals

Starter 3

1 1.32, 1.29, 1.204, 1.2
2 3.54, 3.47, 3.4, 3.239, 3.2
3 5.31, 5.307, 5.3, 5.299, 5.29
4 0.207, 0.13, 0.100 4, 0.099, 0.039
5 0.47, 0.4291, 0.4, 0.044 4, 0.04, 0.004
6 3.333, 3.33, 3.303, 3.3, 3.03, 3.003

Worksheet 3S.1

1 **a)** 8.4 **b)** 19.9 **c)** 32.71
d) 10.08 **e)** 245.01
2 **a)** 0.8 **b)** 0.04 **c)** 0.002
d) 3.7 **e)** 0.55 **f)** 0.006

Worksheet 3S.2

1 **a)** Colin **b)** Dawud, Anne **c)** Emily
2 William
3 **a)** 5.65 **b)** 2.83 **c)** 20.5
d) 0.70 **e)** 1.9 **f)** 8.243
4 **a)** Gabrielle **b)** Isabel **c)** Vault
d) Harriet **e)** Florence, 34.71
5 Choice of answers

Exercise 3.1

1 **a)** 4.3 **b)** 5.6 **c)** 7.2 **d)** 8.6
e) 9.0 **f)** 100.0 **g)** 10.0 **h)** 8.0
2 **a)** 1.11 **b)** 7.65 **c)** 3.28 **d)** 3.01
e) 3.10 **f)** 2.30 **g)** 5.20 **h)** 10.00
3 **a)** 3.0 **b)** 3.05 **c)** 3.049 **d)** 3.0490

Worksheet 3.1

1 **a)** 1.4 **b)** 4.5 **c)** 15.3
d) 4.9 **e)** 12.6
2 **a)** 3.1 **b)** 3.14 **c)** 3.142 **d)** 3.1416

3 a)

Malcolm	19.8 m
Nicola	20.3 m
Olga	27.7 m
Petra	26.4 m
Quinton	19.9 m

b) Malcolm

Exercise 3.2

1 a) 5.1 **b)** 7.6 **c)** 3.0 **d)** 0.056
e) 0.000 12 **f)** 0.003 1 **g)** 0.000 50 **h)** 12
2 a) 3.12 **b)** 1.76 **c)** 0.123 **d)** 0.679
e) 0.022 0 **f)** 0.002 00 **g)** 0.003 20 **h)** 10.0
3 a) (i) 1 **(ii)** 1.0
b) (i) 1.0 **(ii)** 1.04
c) (i) 1.04 **(ii)** 1.044
d) (i) 1.044 **(ii)** 1.044 0

Worksheet 3.2

1

Number	1 s.f.
43.18	40
109.6	100
5378	5000
1865	2000
28 947	30 000
8098	8000

2 a) 68 000, 52 000, 46 000, 48 000, 42 000
b) 70 000, 50 000, 50 000, 50 000, 40 000
c) Newcastle, Liverpool, Manchester City
3 ROUNDING

Exercise 3.3

1 a) 0.6 **b)** 1.2 **c)** 8.1
d) 11.67 **e)** 9.98 **f)** 5.73
2 a) 0.63 **b)** 4.05 **c)** 6.42
d) 10.76 **e)** 11.742 **f)** 9.15
3 a) 0.1 **b)** 0.6 **c)** 1.12
d) 1.64 **e)** 1.38 **f)** 1.51
4 a) 1.41 **b)** 7.42 **c)** 5.77
d) 1.46 **e)** 1.37 **f)** 2.86

Worksheet 3.3–3.5

1 1.55 m
2 27.9 km
3 £60.95
4 a) 135.8 kg **b)** 5.4 kg
5 a) Gina: 0.05 m; Harry 0.2 m; Izzy 0.02 m; Jim 0.01 m
b) Jim
6 a) 0.1 **b)** 0.01 **c)** 1.01 **d)** 1.001
e) 1.1 **f)** 0.11 **g)** 1.011
7 a) £5.40 **b)** £7.50 **c)** £5.25 **d)** £9.60
e) £2.25
8 0.8 kg
9 a) = **d)** = 2.03 **b)** = **c)** = 3.22
e) = **g)** = 1.13 **f)** = 1.11, odd one out
10 £17.50

Exercise 3.4

1 a) 1.5 **b)** 1.6 **c)** 2.8 **d)** 4.8
e) 0.24 **f)** 0.63 **g)** 0.012 **h)** 0.0042
i) 0.000 2 **j)** 0.55 **k)** 0.012 **l)** 0.2
2 a) 0.306 **b)** 1.072 **c)** 26.52
d) 17.48 **e)** 3.516 **f)** 46.369
3 a) 501.7 **b)** 50.17 **c)** 5.017 **d)** 50.17
4 a) 1301.8 **b)** 130.18 **c)** 13.018 **d)** 130.18

Exercise 3.5

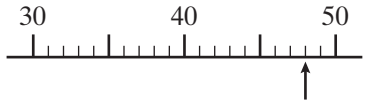
1 a) 40 **b)** 20 **c)** 10 **d)** 200
e) 500 **f)** 300 **g)** 200 **h)** 4000
2 a) 8 **b)** 3 **c)** 4 **d)** 2
e) 30 **f)** 5 **g)** 80 **h)** 8
3 a) 160 **b)** 1600 **c)** 16 **d)** 1.6
4 a) (i) 14 **(ii)** 14 **(iii)** 140
b) (i) 17 **(ii)** 17 **(iii)** 1.7

Exercise 3.6

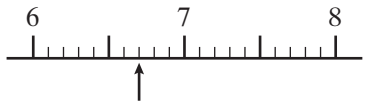
1 a) 22.1 **b)** 22.9 **c)** 23.7 **d)** 24.3
2 a) 10.2 **b)** 11.8 **c)** 13.4 **d)** 14.6
3 a) 46
b) 3.4
c)

d)

4 a) 580 **b)** 7.2
c)



d)



Exercise 3.7

1 a) £1.35 **b)** 65p
2 £49
3 a) £7.03 **b)** £3.53
4 a) £35.94
5 a) £38.50 **b)** £13.40 **c)** £51.90
6 a) £387.35 **b)** 4 hours
7 a) 5 days **b)** £186.25
8 £1.42

Review Exercise 3

1 a) (i) 2.3 **(ii)** 2.35
b) (i) 5.0 **(ii)** 5.03
c) (i) 4.3 **(ii)** 4.32
d) (i) 6.9 **(ii)** 6.90
2 a) 5.55, 5.5, 5.055, 5.05, 5.005
b) 4.21, 4.2, 4.12, 4.11, 4.1, 4.01
c) 3.88, 3.8, 3.78, 3.7, 3.08, 3.07
3 a) 0.1 **b)** 10.83 **c)** 0.2 **d)** 0.072
e) 50 **f)** 2 **g)** 8.16 **h)** 40
i) 4.352 **j)** 4.032
4 Ken £1020, Lisa £8.06

5 **a)** 855.4 kg **b)** 14
6 Natasha £1.60, Kelly £2.05
7 £190.12 **8** £2.43
9 **a)** £458.40 **b)** £14.50
10 **a)** **(i)** 4 **(ii)** 4.1
b) **(i)** 0.03 **(ii)** 0.035
c) **(i)** 0.09 **(ii)** 0.087
d) **(i)** 0.000 4 **(ii)** 0.000 44
11 **a)** 2.21 **b)** 0.013
12 **a)** 119.31 **b)** 119 310 **c)** 1230
13 **a)** 45 mph **b)** 5.3 amps
14 **a)** £1.22 **b)** 14 **c)** £170.80
15 **a)** 8 days **b)** £128.52
16 **a)** £5.55 **b)** 21

Worksheet 3R
DECIMALS ARE EASY

Chapter 4: Fractions

Starter 4
1 **a)** **(i)** $\frac{2}{8}$ or $\frac{1}{4}$ **(ii)** $\frac{6}{8}$ or $\frac{3}{4}$
b) **(i)** $\frac{10}{16}$ or $\frac{5}{8}$ **(ii)** $\frac{6}{16}$ or $\frac{3}{8}$
c) **(i)** $\frac{8}{16}$ or $\frac{1}{2}$ **(ii)** $\frac{8}{16}$ or $\frac{1}{2}$
d) **(i)** $\frac{16}{32}$ or $\frac{1}{2}$ **(ii)** $\frac{16}{32}$ or $\frac{1}{2}$
e) **(i)** $\frac{13}{16}$ **(ii)** $\frac{3}{16}$
f) **(i)** $\frac{11}{32}$ **(ii)** $\frac{21}{32}$
2 Many possible answers **3** 1 : 3

Worksheet 4S.1
1 $\frac{3}{8}$ **2** $\frac{15}{16}$ **3** $\frac{4}{9}$ **4** $\frac{5}{8}$
5 $\frac{1}{6}$ **6** $\frac{7}{12}$ **7** $\frac{13}{16}$ **8** $\frac{3}{10}$

Worksheet 4S.2
1 **c)** $\frac{3}{4}$ **2** **c)** $\frac{2}{7}$ **3** **c)** $\frac{3}{4}$

Exercise 4.1
1 **a)** 0.5 **b)** 0.75 **c)** 0.875 **d)** 0.7
e) $0.\dot{6}$ **f)** $0.\dot{2}$ **g)** $0.5\dot{3}$ **h)** 0.85
2 **a)** $\frac{7}{8}$, $\frac{4}{5}$, $\frac{3}{4}$, 0.72, 0.7 **b)** $\frac{3}{8}$, $\frac{1}{3}$, 0.33, 0.303, $\frac{3}{10}$
c) 0.8, 0.78, $\frac{11}{15}$, 0.73, $\frac{7}{10}$ **d)** 0.91, $\frac{9}{10}$, $\frac{8}{9}$, $\frac{6}{7}$, 0.8
3 **a)** 0.4 **b)** 0.2 **c)** 0.5
d) 0.125 **e)** 0.375 **f)** 0.12
g) 0.28 **h)** 0.95 **i)** 0.45

Worksheet 4.1A
1 $\frac{1}{2}$ and 0.5; $\frac{3}{100}$ and 0.03; $\frac{1}{4}$ and 0.25; $\frac{2}{5}$ and 0.4; $\frac{7}{8}$ and 0.875; $\frac{3}{4}$ and 0.75; $\frac{6}{10}$ and 0.6
2 **a)** $\frac{6}{10}$ **b)** $\frac{1}{4}$ **c)** 0.85 **d)** 0.77
3

Fraction	Calculator display	Recurring notation	Round to 2 d.p.
$\frac{1}{3}$	0.3333333333	$0.\dot{3}$	0.33
$\frac{2}{3}$	0.6666666	$0.\dot{6}$	0.67
$\frac{4}{9}$	0.44444444	$0.\dot{4}$	0.44
$\frac{8}{9}$	0.888888888	$0.\dot{8}$	0.89
$\frac{8}{15}$	0.533333333	$0.5\dot{3}$	0.53

4 **a)** Xavier **b)** Steve **c)** Verla

Worksheet 4.1B
1 **b)** $\frac{1}{3} = \frac{2}{6}$; numerator and denominator: $\times 2$
c) $\frac{1}{4} = \frac{3}{12}$; numerator and denominator: $\times 3$
d) $\frac{2}{8} = \frac{6}{24}$; numerator and denominator: $\times 3$
2 **a)** $\frac{10}{15}$ **b)** $\frac{12}{40}$ **c)** $\frac{6}{21}$ **d)** $\frac{5}{20}$
3 **a)** $\frac{2}{5}$ **b)** $\frac{3}{9}$ **c)** $\frac{15}{36}$
4 **a)** $\frac{6}{9} = \frac{2}{3}$ **b)** $\frac{2}{3} = \frac{8}{12}$ **c)** $\frac{5}{15} = \frac{1}{3}$

Exercise 4.2
1 $\frac{2}{3} = \frac{8}{12} = \frac{10}{15}$
$\frac{3}{8} = \frac{21}{56} = \frac{12}{32}$
$\frac{3}{7} = \frac{60}{140} = \frac{15}{35}$
2 **a)** $\frac{1}{2}$ **b)** $\frac{3}{4}$ **c)** $\frac{1}{4}$ **d)** $\frac{1}{9}$
e) $\frac{6}{7}$ **f)** $\frac{4}{5}$ **g)** $\frac{27}{40}$ **h)** $\frac{5}{8}$
3 **a)** $\frac{1}{3} = \frac{2}{6} = \frac{3}{9} = \frac{4}{12} = \frac{5}{15}$ **b)** $\frac{3}{8} = \frac{9}{24} = \frac{15}{40} = \frac{21}{56}$
c) $\frac{4}{5} = \frac{8}{10} = \frac{20}{25} = \frac{28}{35} = \frac{40}{50}$ **d)** $\frac{2}{3} = \frac{8}{12} = \frac{14}{21} = \frac{20}{30} = \frac{30}{45}$
4 **a)** $\frac{4}{12}, \frac{2}{3}, \frac{5}{6}$ **b)** $\frac{3}{8}, \frac{1}{2}, \frac{5}{8}, \frac{3}{4}$ **c)** $\frac{1}{5}, \frac{3}{10}, \frac{7}{10}, \frac{4}{5}$
d) $\frac{1}{6}, \frac{1}{3}, \frac{7}{18}, \frac{5}{9}$ **e)** $\frac{1}{2}, \frac{3}{5}, \frac{7}{10}, \frac{3}{4}, \frac{16}{20}$ **f)** $\frac{7}{12}, \frac{2}{3}, \frac{3}{4}, \frac{19}{24}, \frac{5}{6}$

Exercise 4.3
1 $\frac{1}{2}$ **2** $\frac{3}{4}$ **3** $\frac{1}{5}$
4 $\frac{9}{10}$ **5** $\frac{19}{20}$ **6** $\frac{7}{20}$
7 $\frac{33}{40}$ **8** $\frac{91}{200}$ **9** $\frac{16}{125}$

Exercise 4.4
1 **a)** $\frac{2}{3}$ **b)** $\frac{5}{7}$ **c)** $\frac{15}{17}$
d) $\frac{3}{4}$ **e)** $\frac{3}{4}$ **f)** $\frac{2}{3}$
2 **a)** $\frac{3}{5}$ **b)** $\frac{5}{9}$ **c)** $\frac{11}{24}$
d) $\frac{1}{2}$ **e)** $\frac{3}{5}$ **f)** $\frac{1}{3}$
3 **a)** $\frac{9}{10}$ **b)** $\frac{1}{4}$ **c)** $\frac{1}{3}$
d) $\frac{4}{15}$ **e)** $\frac{3}{4}$ **f)** $\frac{2}{3}$
g) $\frac{1}{3}$ **h)** $\frac{1}{3}$ **i)** $\frac{11}{14}$
4 **a)** $\frac{5}{6}$ **b)** $\frac{11}{20}$ **c)** $\frac{17}{30}$ **d)** $\frac{1}{6}$
e) $\frac{31}{56}$ **f)** $\frac{5}{12}$ **g)** $\frac{11}{40}$ **h)** $\frac{7}{12}$
i) $\frac{3}{20}$ **j)** $\frac{2}{3}$ **k)** $\frac{29}{60}$ **l)** $\frac{7}{12}$
5 **a)** $\frac{3}{5}$ **b)** $\frac{2}{5}$
6 **a)** $\frac{19}{24}$ **b)** $\frac{5}{24}$

Worksheet 4.4A
1 **a)** $\frac{3}{5}$ **b)** $\frac{2}{5}$
2 $\frac{5}{7}$
3 $\frac{1}{6} + \frac{4}{6} = \frac{5}{6}$; $\frac{6}{8} - \frac{1}{8} = \frac{5}{8}$; $\frac{4}{10} + \frac{3}{10} = \frac{7}{10}$; $\frac{4}{11} - \frac{1}{11} = \frac{3}{11}$;
$\frac{5}{7} + \frac{1}{7} = \frac{6}{7}$; $\frac{2}{5} - \frac{1}{5} = \frac{1}{5}$
4 **a)** $\frac{1}{4} + \frac{3}{8} = \frac{2}{8} + \frac{3}{8} = \frac{5}{8}$
b) $\frac{3}{10} + \frac{7}{20} = \frac{6}{20} + \frac{7}{20} = \frac{13}{20}$
c) $\frac{11}{15} - \frac{2}{3} = \frac{11}{15} - \frac{10}{15} = \frac{1}{15}$

Worksheet 4.4B
1 **a)** $\frac{7}{3}$ **b)** $\frac{13}{4}$ **c)** $\frac{22}{5}$ **d)** $3\frac{1}{2}$
e) $3\frac{1}{3}$ **f)** $3\frac{2}{5}$ **g)** $2\frac{1}{4}$ **h)** Wrong
i) **(i)** 7 **(ii)** 14
j) **(i)** 5 **(ii)** $\frac{1}{2}$

Exercise 4.5

1 **a)** $\frac{5}{4}$ **b)** $\frac{5}{3}$ **c)** $\frac{9}{7}$ **d)** $\frac{11}{2}$
e) $\frac{15}{4}$ **f)** $\frac{29}{6}$ **g)** $\frac{21}{8}$ **h)** $\frac{41}{9}$

2 **a)** $3\frac{1}{2}$ **b)** $2\frac{1}{3}$ **c)** $2\frac{1}{4}$ **d)** $1\frac{6}{7}$
e) $2\frac{2}{3}$ **f)** $2\frac{4}{9}$ **g)** $6\frac{1}{4}$ **h)** $4\frac{1}{4}$

3 **a)** $4\frac{2}{3}$ **b)** 2 **c)** $3\frac{4}{7}$
d) $1\frac{1}{2}$ **e)** $5\frac{1}{5}$ **f)** $\frac{3}{5}$

4 **a)** $2\frac{1}{2}$ **b)** $1\frac{1}{10}$ **c)** $1\frac{1}{8}$
d) $1\frac{1}{4}$ **e)** $3\frac{5}{6}$ **f)** $4\frac{1}{6}$
g) $1\frac{5}{12}$ **h)** $1\frac{1}{35}$ **i)** $2\frac{1}{12}$

Exercise 4.6

1 **a)** $\frac{8}{15}$ **b)** $\frac{10}{63}$ **c)** $\frac{1}{6}$
d) $\frac{3}{25}$ **e)** $1\frac{3}{32}$ **f)** $1\frac{7}{9}$

2 **a)** $\frac{5}{6}$ **b)** $\frac{8}{21}$ **c)** $\frac{2}{3}$
d) $4\frac{1}{2}$ **e)** $\frac{16}{25}$ **f)** $4\frac{7}{12}$

3 **a)** $\frac{1}{8}$ **b)** $\frac{10}{27}$ **c)** $1\frac{1}{2}$ **d)** $1\frac{2}{3}$
e) $\frac{2}{3}$ **f)** $\frac{2}{5}$ **g)** $\frac{1}{3}$ **h)** $\frac{2}{15}$
i) 1 **j)** $2\frac{1}{4}$ **k)** $7\frac{1}{2}$ **l)** $3\frac{1}{5}$

Exercise 4.7

1 **a)** 9 **b)** 4 **c)** 3
d) 20 **e)** 10 **f)** 8

2 **a)** 12 **b)** 4 **c)** 24
d) 44 **e)** 63 **f)** 42
g) 44 **h)** 27 **i)** 60

3 **a)** 56 **b)** $\frac{19}{20}$ **c)** 1064

4 Bill's Bikes

5 **a)** £6.40 **b)** £15

6 **a)** £16.50 **b)** £65

Worksheet 4.7

1 **a)** 30 minutes **b)** 20 cm **c)** 250 g **d)** 120°

2 Rima £20, Sam £40, Tom £80

3 $\frac{2}{3}$ of 6 (4) $\rightarrow \frac{3}{5}$ of 10 (6) $\rightarrow \frac{1}{3}$ of 15 (5) $\rightarrow \frac{1}{2}$ of 14 (7) $\rightarrow \frac{2}{3}$ of 9 (6) $\rightarrow \frac{1}{4}$ of 20 (5) $\rightarrow \frac{1}{5}$ of 30 (6)

Review Exercise 4

1 **a)** $\frac{1}{2}$ **b)** $\frac{3}{4}$ **c)** $\frac{1}{3}$
d) $\frac{2}{5}$ **e)** $\frac{5}{9}$ **f)** $\frac{9}{10}$

2 **a)** $\frac{1}{8}$ **b)** $\frac{4}{5}$ **c)** $\frac{7}{10}$
d) $\frac{11}{25}$ **e)** $\frac{7}{8}$ **f)** $\frac{27}{40}$

3 **a)** $\frac{2}{4} = \frac{1}{2}$ **b)** $\frac{3}{5}$ **c)** $\frac{6}{7}$
d) $\frac{5}{9}$ **e)** $\frac{6}{17}$ **f)** $\frac{2}{15}$

4 **a)** $\frac{5}{12}$ **b)** $\frac{5}{9}$ **c)** $\frac{1}{40}$
d) $\frac{19}{28}$ **e)** $\frac{1}{3}$ **f)** $\frac{1}{9}$

5 **a)** $\frac{1}{2}$ **b)** $\frac{3}{14}$ **c)** $\frac{1}{2}$
d) $\frac{3}{32}$ **e)** $\frac{1}{3}$ **f)** $\frac{7}{8}$

6 **a)** $1\frac{3}{4}$ **b)** $1\frac{4}{5}$ **c)** $1\frac{5}{7}$ **d)** $3\frac{3}{5}$

7 **a)** $\frac{13}{9}$ **b)** $\frac{8}{3}$ **c)** $\frac{22}{7}$ **d)** $\frac{17}{6}$

8 **a)** $2\frac{2}{3}$ **b)** $1\frac{1}{4}$ **c)** $1\frac{11}{20}$

9 **a)** 6 **b)** 48 **c)** 18
d) 25 **e)** 3 **f)** 30

10 **a)** 9, 37, 56, 59, 75
b) 0.067, 0.56, 0.6, 0.605, 0.65
c) −10, −6, −4, 2, 5
d) $\frac{2}{5}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}$

11 **a)** $\frac{3}{4}$ **b)** Various arrangements

12 $\frac{3}{5} = \frac{9}{15}, \frac{2}{3} = \frac{10}{15}$, so $\frac{2}{3}$ is larger

13 **a)** **(i)** $\frac{1}{2}$
(ii) Various arrangements
b) **(i)** 40 **(ii)** 150 000
(iii) 6.55 **(iv)** $\frac{3}{8}$

14 $\frac{5}{12}$

15 **a)** $\frac{1}{12}$ **b)** 140

16 **a)** $\frac{1}{2}$ **b)** $4\frac{5}{12}$

17 **a)** 0.5 **b)** 0.25 **c)** 0.75
d) 0.375 **e)** $0.6\dot{6}$ **f)** $0.5\dot{5}$

18 **a)** $\frac{3}{4}$ **b)** £15.54

19 **a)** $\frac{1}{6}, \frac{3}{8}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}$
b) $\frac{3}{5}$, 0.65, $\frac{2}{3}$, 0.72, $\frac{3}{4}$

20 **a)** £72.96 **b)** 87

Internet Challenge 4

1 $\frac{1}{6}$ **2** $\frac{11}{20}$ **3** $\frac{1}{4} + \frac{1}{2}$
4 $\frac{1}{2} + \frac{1}{3} + \frac{1}{6}$ **5** $\frac{1}{2} + \frac{1}{4} + \frac{1}{36}$ **6** Yes

7 To obtain $\frac{5}{8}$ of each sack, divide each sack in half and put aside one half. Halve the other half to get one quarter, and halve this to get one eighth. Add this to the half set aside. ($\frac{5}{8} = \frac{1}{2} + \frac{1}{8}$)

Chapter 5: Percentages

Starter 5

$8 \times 2 \times 2 \times 6 = 192$

Exercise 5.1

1 **a)** 0.23 **b)** 0.54 **c)** 0.64 **d)** 0.07
e) 0.27 **f)** 0.105 **g)** 1.13 **h)** 0.005

2 **a)** 65% **b)** 70% **c)** 41% **d)** 1%
e) 90% **f)** 3% **g)** 120% **h)** 137%

3 **a)** 34% **b)** 22% **c)** 64% **d)** 26%
e) 32% **f)** 30% **g)** 90% **h)** 80%

4 **a)** $\frac{7}{10}$ **b)** $\frac{7}{20}$ **c)** $\frac{21}{25}$ **d)** $\frac{99}{100}$
e) $\frac{1}{50}$ **f)** $\frac{7}{40}$ **g)** $\frac{23}{20}$ **h)** $\frac{6}{5}$

5 **a)** 50% **b)** 60% **c)** 25% **d)** 20%
e) 20% **f)** 22.5% **g)** 45% **h)** 17.5%

6

%	Decimal	Fraction
1%	0.01	$\frac{1}{100}$
10%	0.1	$\frac{1}{10}$
12.5%	0.125	$\frac{1}{8}$
20%	0.2	$\frac{1}{5}$
25%	0.25	$\frac{1}{4}$
$33.\dot{3}$%	$0.\dot{3}$	$\frac{1}{3}$
50%	0.5	$\frac{1}{2}$
$66.\dot{6}$%	$0.\dot{6}$	$\frac{2}{3}$
75%	0.75	$\frac{3}{4}$
80%	0.8	$\frac{4}{5}$
90%	0.9	$\frac{9}{10}$

Exercise 5.2

1 Theme park 50%, prom 40%, picnic 10%
2 **a)** £3000 **b)** 25%
3 **a)** £200 **b)** 40%
4 **a)** English 50%, French 25%, Maths 75%, Science 80%, Art 35%, German 65%
b) Science
5 **a)** 10% profit **b)** 10% loss
c) 22.5% profit **d)** 5% loss

Worksheet 5.2/5.3

1 £20, £10 **2** £9, £18 **3** £70, £140
4 £8, £4 **5** £12, £6 **6** £15, £30
7 \$14, \$7 **8** 90 cm, 180 cm
9 £40 + £20 = £60
10 £6 + £3 = £9
11 £8 + £4 = £12
12 £12 + £12 = £24
13 \$15 + \$15 = \$30
14 \$22 + \$22 = \$44
15 £4 + £4 + £2 = £10
16 \$9 + \$9 +\$4.50 = \$22.50

Exercise 5.3

1 **a)** 150 **b)** 19.2 **c)** 4.5 **d)** 32
e) 34.3 **f)** 64 **g)** 1.92 **h)** 0.56
i) 87.5 **j)** 2.25 **k)** 72 **l)** 1035
2 £104.13
3 **a)** 53% **b)** 477
4 Mel did better: 87% of 140 is 122, or $\frac{120}{140}$ is 86%
5 **a)** £1500 **b)** £1020 **c)** £1875

Exercise 5.4

1 **a)** **(i)** 5 **(ii)** 2.5 **(iii)** 7.5
b) **(i)** 70 **(ii)** 35 **(iii)** 105
c) **(i)** 120 **(ii)** 60 **(iii)** 180
d) **(i)** 8.2 **(ii)** 4.1 **(iii)** 12.3
2 **a)** 50 **b)** 15 **c)** 1050 **d)** 22
3 **a)** 31 **b)** 105 **c)** 9
d) 9 **e)** 4.5 **f)** 14
g) 54 **h)** 540 **i)** 480
4 **a)** £26.25 **b)** £1295 **c)** £15.75
5 **a)** £12 **b)** £10.50 **c)** £48
6 **a)** £80 **b)** £8 **c)** 1% of £800
7 **a)** £12 **b)** £6 **c)** 10% of £60

Worksheet 5.4

1 £8 + £4 + £2 = £14; £80 + £14 = £94
2 £12 + £6 + £3 = £21; £120 + £21 = £141
3 \$4 +\$2 + \$1 = \$7; \$40 + \$7 = \$47
4 £46 + £23 + £11.50 = £80.50; £460 + £80.50 = £540.50
5 £3.60 + £1.80 + 90p = £6.30; £36 + £6.30 = £42.30
6 £5 + £2.50 + £1.25 = £8.75; £50 + £8.75 = £58.75
7 £9 + £4.50 + £2.25 = £15.75; £90 + £15.75 = £105.75
8 £7 + £3.50 + £1.75 = £12.25; £70 + £12.25 = £82.25
9 £32 + £3.20 + £1.60 + 80p = £37.60
So £50 is enough
10 £560 + £56 + £28 + £14 = £658

Exercise 5.5

1 1200
2 76.5 kg
3 £6864
4 Widescreen televisions £728, DVD players £84, stereos £1232, laptops £896
5 £76.38
6 £4450.50

Worksheet 5.5

1 Regency B.S. 5.2%, Makedo Bank 4.9%, Clyde Savings 4.8%, BHA Savings 4.7%, Helpful B.S. 4.6%, Metro Bank 4.4%
2 **a)** Regency £10.40, Makedo £9.80, Clyde £9.60, BHA £9.40, Helpful £9.20, Metro £8.80
b) Table entries in same order as previous table
3 £57.20
4 **a)** £62.40 **b)** £52.80 **c)** £9.60

Exercise 5.6

1 **a)** £8400 **b)** £8820 **c)** £9261
2 **a)** £11 900 **b)** £10 115 **c)** £8597.75
3 £4900.17
4 £274 000

Review Exercise 5

1 **a)** 40% **b)** 210
2 **a)** 0.87 **b)** 40% **c)** $\frac{3}{5}$
d) 5 500 000 **e)** 45%
3 **a)** 25% **b)** $\frac{2}{5}$
c) 0.98 **d)** 7 500 000
4 **a)** 13, 67, 76, 103, 130
b) −7, −3, −1, 0, 5
c) 0.07, 0.072, 0.7, 0.702, 0.72
d) 0.6, $\frac{2}{3}$, 70%, $\frac{3}{4}$
5 5%
6 **a)** £36 **b)** £85.50 **c)** £51
7 **a)** 656
b) No, 25% of 800 = 200
c) 360
d) 22%
8 £9720
9

Percentage	Decimal	Fraction
65%	0.65	$\frac{13}{20}$
95%	0.95	$\frac{19}{20}$
85%	0.85	$\frac{17}{20}$
62.5%	0.625	$\frac{5}{8}$
30%	0.3	$\frac{3}{10}$
22.5%	0.225	$\frac{9}{40}$

10 **a)** $\frac{7}{100}$ **b)** 0.18 **c)** 40
11 **a)** £21 **b)** 47.1 kg
12 £14 734.50
13 **a)** 6 hours **b)** £225.84
14 £75.20
15 Say normal price is £100, so sale price is £80
Fun Friday price is £56 (not £50)
Reduction is 44%

Worksheet 5R

Q	G	E	B	X	E	N	M	M	B
S	T	A	H	A	T	U	P	F	U
A	M	L	K	S	N	S	R	A	I
V	O	W	E	J	Y	K	O	O	L
I	N	T	E	R	E	S	T	C	D
N	E	N	B	A	A	A	U	T	I
G	Y	A	Q	T	R	M	E	V	N
S	S	M	P	E	S	O	D	S	G
S	C	E	E	L	E	U	B	D	M
O	A	K	R	N	R	N	M	N	A
E	S	O	C	I	E	T	Y	U	N
R	H	D	E	S	U	M	R	O	W
A	I	A	N	M	U	C	L	P	E
M	A	R	T	E	R	N	U	U	T

Word not in wordsearch: MANAGER

Internet Challenge 5

1 The RPI is an average measure of change in the prices of goods and services bought by the vast majority of households in the UK.
2 It is compiled and published monthly.
3 2.2% (December 2005), updates available at www.statistics.gov.uk/.
4 The Bank of England sets a rate at which it lends money to other financial institutions; this in turn affects the rates building societies and so on charge their customers.
5 It is reviewed monthly.

Chapter 6: Powers and roots

Starter 6

The only light bulbs that remain on are those with an **odd** number of factors, i.e. the square numbers 1, 4, 9, 16, 25, 36, 49, 64, 81 and 100.

Exercise 6.1

1 a) (i) 12, 24, 36, 48, 60, 72
(ii) 20, 40, 60, 80, 100, 120
(iii) 24, 48, 72, 96, 120, 144
(iv) 36, 72, 108, 144, 180, 216
(v) 60, 120, 180, 240, 300, 360
b) (i) 60 **(ii)** 72 **(iii)** 120
(iv) 120 **(v)** 60 **(vi)** 180
2 a) (i) 1, 2, 3, 4, 6, 12
(ii) 1, 2, 4, 5, 10, 20
(iii) 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72
(iv) 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 30, 36, 45, 60, 90, 180
b) (i) 4 **(ii)** 36 **(iii)** 20
3 7, 11, 23 and 61 have exactly 2 factors.
4 a) 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97 are prime.
b) Yes: No even number (other than 2) may be prime as it is divisible by 2.
c) Yes:
'1' after a multiple of 6 is odd, so it could be prime
'2' after a multiple of 6 is even, so can't be prime
'3' after a multiple of 6 is divisible by 3, so can't be prime
'4' after a multiple of 6 is even
'5' after a multiple of 6 is odd , so could be prime
'5' after is the same as '1' before.

Exercise 6.2

1 a) 25 **b)** 36 **c)** 81 **d)** 144 **e)** 225
2 a) 4 **b)** 16 **c)** 49 **d)** 1 **e)** 169
3 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225
4 a) 1 **b)** 7 **c)** 8 **d)** 15 **5** 100
6 a) (i) 9 **(ii)** 25 **(iii)** You get original number.
b) (i) 5 **(ii)** 10 **(iii)** 17
7 a) 3 **b)** 4 **c)** 8 **d)** 7
8 a) 6.7 **b)** 12.2 **c)** 9.5 **d)** 7.7
9 a) ± 5 **b)** ± 4 **c)** ± 10 **d)** ± 12

Exercise 6.3

1 a) 17 **b)** 9.3 **c)** 0.1 **d)** 7.2
2 a) 5.3 **b)** 22.1 **c)** 163.8 **d)** 1030.4
3 a) 624 **b)** 6.45 **c)** 0.847
4 a) 31.8 **b)** 25.3 **c)** 2.74
5 a) ± 25 **b)** ± 0.5 **c)** ± 11.5 **d)** ± 4.2

Exercise 6.4

1 1, 8, 27, 64, 125
2 a) 1000 **b)** 343 **c)** 512 **d)** 0.001
3 a) 9 **b)** 6 **c)** 1.5 **d)** 0.2

Exercise 6.5

1 a) 4^6 **b)** 3^5 **c)** 9^4
d) 7^7 **e)** 2.1^6 **f)** 3.7^4
2 a) 78 125 **b)** 19 683 **c)** 16 384
d) 256 **e)** 32 **f)** 16 807
3 a) 3 **b)** 8 **c)** 2
d) 1 **e)** 9 **f)** 6
4 a) $2^2 = 2^7 \div 2^5$
$2^4 = 2^9 \div 2^5$
$2^5 = 2^6 \div 2$
$2^6 = 2^2 \times 2^4$
$2^7 = 2^3 \times 2^4$
$2^{10} = 2^4 \times 2^6$
b) $2^a \div 2^b = 2^{a-b}$
$2^a \times 2^b = 2^{a+b}$

Exercise 6.6

1 a) 5^{14} **b)** 4^9 **c)** 12^6 **d)** 3^{14}
e) 11^{12} **f)** 6^9 **g)** 8^4 **h)** 20^7
i) 9^{27} **j)** 16^{10} **k)** 7^{100} **l)** 5^{50}
2 a) 5^9 **b)** 4^3 **c)** 6^{15}
3 a) (i) 7^1 **(ii)** 4^1 **(iii)** 2^1
b) (i) 7 **(ii)** 4 **(iii)** 2
c) n
4 a) (i) 3^0 **(ii)** 6^0 **(iii)** 8^0
b) (i) 1 **(ii)** 1 **(iii)** 1
c) (i) 1

Exercise 6.7

1 a) $2^2 \times 3^2$ **b)** $2^4 \times 5$ **c)** $2^3 \times 3^2$
d) $2 \times 3 \times 5^2$ **e)** $2^2 \times 5 \times 7$ **f)** $2 \times 3^2 \times 11$
g) $2^2 \times 13$ **h)** $2^3 \times 3^2 \times 5$ **i)** $2^2 \times 3^2 \times 11$

2 a) (i) 4 **(ii)** 720
b) (i) 20 **(ii)** 560
c) (i) 6 **(ii)** 1800
d) (i) 198 **(ii)** 396
e) (i) 4 **(ii)** 468
f) (i) 30 **(ii)** 1800
g) (i) 36 **(ii)** 360
h) (i) 36 **(ii)** 792
i) (i) 20 **(ii)** 2520

Exercise 6.8

1 a) 1 **b)** $\frac{1}{7}$ **c)** $\frac{1}{8}$ **d)** 10
e) 4 **f)** 6 **g)** $\frac{5}{3}$ **h)** $\frac{9}{2}$

2 a) (i) $\frac{1}{2}$ **(ii)** 5 **(iii)** $\frac{4}{3}$
b) (i) 2 **(ii)** 0.2 **(iii)** $\frac{3}{4}$
c) When you find a reciprocal of a number's reciprocal you get back to the original number.

3 a) All the answers are 1.
b) When you multiply a number by its reciprocal, the answer is 1.

Exercise 6.9

1 a) 14 **b)** 14 **c)** 13 **d)** 65
e) 5 **f)** 7 **g)** 6 **h)** 5

2 a) 10.5 **b)** 2.8 **c)** 2.3 **d)** 67.5
e) 237.0 **f)** 2.3 **g)** 2.2 **h)** 12.9

3 a) $(3.2 + 2.4) \times 4.1 - 1.1 = 21.86$
b) $(8.5 - 3.6) \times (2.9 + 1.7) = 22.54$
c) $5.1 + (5.6 - 2.9) \times 1.6 + 2.9 \times 7.2 = 30.3$

Exercise 6.10

1 a) 10 000 **b)** 10 000 000 **c)** 100 000 000

2 a) 10^2 **b)** 10^5 **c)** 10^{14}

3 100

4 a) 4000 **b)** 320 000 **c)** 260 000 000
d) 178 000 **e)** 32 400 000 000
f) 51 298 000

5 a) 1.28×10^{10} **b)** 2.5×10^{13}
c) 1.702×10^{14} **d)** 4×10^{11}

Worksheet 6R

1 SID	**2** BILL	**3** ZOO
4 OH	**5** SID	**6** I
7 SEE	**8** BIG	**9** HEDGEHOG
10 BOOZE	**11** SLOSHED	**12** BILL
13 IS	**14** DOG	**15** GOOSE
16 GOLD	**17** EGG	**18** BOO
19 LESLIE	**20** HE	**21** SLED
22 BOILED	**23** EGGS	**24** SHELL
25 I	**26** HE	**27** SOBBED

Review Exercise 6

1 a) $\frac{1}{9}$ **b)** 12 **c)** $\frac{5}{2} = 2.5$ **d)** $\frac{8}{5}$

2 a) 6, 12 **b)** 4 **c)** 3, 4, 6, 12 **d)** 8, 27

3 a) (i) 25 **(ii)** 28
(iii) 5 and 20 **(iv)** 26 and 33
b) $2^3 = 8$ because $2 \times 2 \times 2 = 8$

4 a) 69 and 18
b) (i) 18 or 36 **(ii)** 16 or 36
c) factor

5 a) 7^7 **b)** 7^6

6 a) $2^2 \times 3^3$ **b)** 12

7 a) 144 **b)** 6

8 a) (i) 3^9 **(ii)** 3^5
b) (i) $x = 9$ **(ii)** $y = 3$

9 $m = 5, n = 3$

10 a) 64 **b)** 3 **c)** 12

11 a) 5.779 745 962 **b)** 6

12 a) 250 000 **b)** 7 million

13 a) 30 **b)** 6.5

14 a) 17.986 7 **b)** $(1.6 + 3.8 \times 2.4) \times 4.2$

15 a) 1.962 631 579 **b)** 1.96

16 a) 0.787 965 006 **b)** 0.79

17 a) (i) $2^2 \times 3 \times 5$ **(ii)** $2^5 \times 3$
b) 12 **c)** 480

18 a) 49 **b)** 11 **c)** 10 000 **d)** 0.1

Internet Challenge 6

1 2×10^{30} **2** 5×10^9 **3** 4×10^6
4 6×10^3 **5** 2.25×10^8 **6** 3×10^8
7 94×10^6 **8** 10^{-9} **9** 2.8×10^6
10 10^{11}

Chapter 7: Working with algebra

Starter 7

1 0; slip $(3 \times 1) = 3$
2 2; slip $6 - (5 + 1) = 0$
3 25; slip $5 \times 2 = 10$
4 14; slip $(2 + 3) \times 4 = 20$
5 9; slip $(4 + 10) \div 2 = 7$
6 9; slip $-3^2 = -9$

Exercise 7.1

1 a) area = 15 cm^2, perimeter = 16 cm
b) area = 24 cm^2, perimeter = 20 cm
c) area = 2 cm^2, perimeter = 9 cm

2 a) 30 km **b)** 240 km **c)** 20 km **d)** 4 km

3 a) £61 **b)** £2

4 a) 260 **b)** 105 **c)** 330 **d)** 110.25

5 a) 23 **b)** 36 **c)** 60 **d)** 20

Exercise 7.2

1 a) $7 + p$ **b)** $y - 10$ **c)** $4 - n$ **d)** $5g$
e) $10h$ **f)** $\frac{18}{k}$ **g)** $\frac{m}{n}$ **h)** cd
i) rs **j)** t^2 **k)** $7t^2$ **l)** $(7t)^2$
m) $3ab$ **n)** x^3y^2

2 a) $3c$ **b)** $3c - 10$
c) $2(3c - 10)$ **d)** 280

3 a) $w + 5$ **b)** $w(w + 5)$
c) (i) 24 cm^2 **(ii)** 14 cm^2 **(iii)** 50 cm^2

4 a) y^2 **b)** $4y^2$ **c)** $2y$
d) $2y \times 2y = (2y)^2 = 4y^2$

Exercise 7.3

1 a) 8 **b)** 5 **c)** 12 **d)** 14
e) 4 **f)** 20 **g)** 15 **h)** 12
i) 39 **j)** 9 **k)** 64 **l)** 60

2 **a)** 8 **b)** 16 **c)** 24
d) 36 **e)** 48 **f)** 20
g) 34 **h)** 32 **i)** 3
3 **a)** 0 **b)** 2 **c)** 6
d) 2 **e)** 6 **f)** 6
4 **a)** 8 **b)** 200 **c)** −14 **d)** 36
5 **a)** 52 **b)** 14 **c)** −22 **d)** 100
6 **a)** 9 **b)** −25 **c)** 5 **d)** 8
e) 24 **f)** −8 **g)** −16 **h)** 18
i) 21 **j)** 33 **k)** −1 **l)** −1
7 **a)** 68.425 **b)** 68
8 **a)** 3625 **b)** 2500

Worksheet 7.3A

1 FRIDAY
2 BACON ROLL
3 THE X FACTOR
4 MAY THE FORCE BE WITH YOU

Worksheet 7.3B

1 TRICK
2 TABLE
3 JAMES BOND
4 MAKE MY DAY
5 CAN YOU SOLVE THIS CODE

Exercise 7.4

1 **a)** $4a$ **b)** $10b$ **c)** $5c$
d) $10d$ **e)** e **f)** 0
g) $-2g$ **h)** $-h$ **i)** $-i$
2 **a)** $2a + 5$ **b)** $4b + 1$ **c)** $c - 1$
d) $3 - d$ **e)** 5 **f)** $6 - 7f$
3 **a)** $2a + 2b$ **b)** $5a + b$ **c)** $5c - d$
d) $c + 8d$ **e)** $-e$ **f)** $-f + g$
g) h **h)** $5g - 5h$ **i)** $5i - 4h$
4 **a)** $4a^2$ **b)** $5b^2$ **c)** $6c^3$
d) $4d^3$ **e)** $e^2 + e$ **f)** fg
g) 0 **h)** $3h^2$ **i)** hi
5 **a)** $x - 3$ **b)** $4x - 6$ **c)** 18 cm
6 **a)** $2n$ **b)** $n - 5$
c) $4n - 5$ **d)** 27

Worksheet 7.4

1 13, 21, 31, 34
2 $4b$, $9t$, $3a + 2b$, $5a$, $11p$
3 **a)** $7b$, $9b$; $16b$ **b)** $3t$, $5t$; $8t$ **c)** $11m$, $9m$; $20m$
4 **a)** $2p$, $3p$; $5p$ **b)** $5r$, $3r$, $5r$; $8r$, $8r$; $16r$
5 **a)** $5a + b$ **b)** $3a + 2b$ **c)** $6a + 5b$
d) $11d + 6e$ **e)** $7x + 5y$ **f)** $7s + 7t$
6 **a)** $3a + p$, $5a + p$; $8a + 2p$
b) $4x + 3y$, $2x + 3y$; $6x + 6y$
c) $3s + 4t$, $4s + 2t$; $7s + 6t$
d) $4r + 6p$, $5r + 3p$; $9r + 9p$
7 **a)** $9x + 3y$, $7x + 2y$; $16x + 5y$
b) $9s + 6t$, $7s + 6t$; $16s + 12t$
c) $3p + 3r$, $5p + 5r$, $7p + 7r$; $8p + 8r$, $12p + 12r$; $20p + 20r$

Exercise 7.5

1 **a)** a^3 **b)** b^6 **c)** c^4
d) $4d^3$ **e)** $7e^2$ **f)** $9f^4$
2 **a)** x^8 **b)** x^5 **c)** y^{10}
d) y^{13} **e)** z^6 **f)** z^9
g) y^{11} **h)** y^7 **i)** x
j) y **k)** x^3 **l)** 1
3 **a)** $10x^7$ **b)** $15x^5$ **c)** $24x^6$
d) $40x^5$ **e)** $8y^6$ **f)** $100x^{10}$
g) $12x^5$ **h)** $6x^9$ **i)** $40x^9$
4 **a)** $2y^3$ **b)** $6z^5$ **c)** $3x^3$
d) $2z^2$ **e)** y **f)** $2y$
g) 2 **h)** x **i)** 1

Exercise 7.6

1 **a)** $2a + 10$ **b)** $12 + 3b$ **c)** $15 - 5c$
d) $7d - 7$ **e)** $3e + 12$ **f)** $36 - 12f$
g) $14g + 14$ **h)** $-2h - 6$ **i)** $-5i + 15$
j) $-6 - 2j$ **k)** $-14 + 7k$ **l)** $-12 + 3l$
2 **a)** $6a + 14$ **b)** $8b + 4$ **c)** $35c - 10$
d) $12 + 36d$ **e)** $26e - 39$ **f)** $21 - 14f$
g) $10g - 5$ **h)** $-6h - 2$ **i)** $-6i - 15$
j) $-6 - 8j$ **k)** $-4k + 6$ **l)** $-21 + 15l$
3 **a)** $7x + 20$ **b)** $8x + 13$ **c)** $11x + 29$
d) $8x + 25$ **e)** $22x + 16$ **f)** $7x + 11$
g) $16x + 19$ **h)** $7x + 4$ **i)** $17x + 1$
j) $38x + 3$
4 **a)** $21x - 9$ **b)** $2x + 10$ **c)** $3x + 3$
d) $31x - 50$ **e)** $31x - 26$ **f)** $6x + 12$
g) $6x + 33$ **h)** $4x + 12$ **i)** $3x - 9$
j) $5x - 3$

Exercise 7.7

1 **a)** $a^2 + 2a$ **b)** $b^2 + 4b$ **c)** $c^2 + c$
d) $3d - d^2$ **e)** $7e - e^2$ **f)** $4f^2 - fg$
g) $3g^2 + gh$ **h)** $3h^2 - 2gh$ **i)** $6hi - i^2$
2 **a)** $2a^2 + 6a$ **b)** $3b^2 + 6b$ **c)** $4c^2 - 4c$
d) $2d - 2d^2$ **e)** $10e^2 - 5e$ **f)** $15f^2 - 3fg$
g) $6g^2 + 6gh$ **h)** $6gh - 2h^2$ **i)** $21hi - 7i^2$
3 **a)** $x^2 + 5x + 6$ **b)** $x^2 + 6x + 8$
c) $x^2 + 7x + 12$ **d)** $x^2 - 5x - 14$
e) $x^2 + x - 2$ **f)** $x^2 - 7x + 10$
g) $x^2 - x - 6$ **h)** $x^2 + 4x + 3$
i) $x^2 - 6x + 8$ **j)** $x^2 + 5x + 4$
k) $x^2 - 4x + 3$ **l)** $x^2 + 9x + 14$
4 **a)** 4
b) **(i)** $2b$ **(ii)** $2b$ **(iii)** b^2
c) $b^2 + 4b + 4$
d) $(b + 2)^2$ is the area of the square.
5 **a)** $a^2 + 6a + 9$ **b)** $b^2 + 2b + 1$
c) $c^2 - 2c + 1$ **d)** $d^2 - 4d + 4$

Worksheet 7.7

1 Area $= (4 \times 3x) + (4 \times 2) = 12x + 8$
2 Area $= (5 \times 2x) + (5 \times 1) = 10x + 5$
3 Area $= (2 \times 5x) + (2 \times 4) = 10x + 8$
4 Area $= (7 \times x) + (7 \times 3) = 7x + 21$
5 Area $= (5 \times 5x) + (5 \times 14) = 25x + 70$
6 Area $= (x \times x) + (x \times 1) + (x \times 4) + (4 \times 1)$
$= x^2 + x + 4x + 4 = x^2 + 5x + 4$
7 Area $= (x \times x) + (x \times 2) + (x \times 2) + (2 \times 2)$
$= x^2 + 2x + 2x + 4 = x^2 + 4x + 4$
8 Area $= (x \times x) + (x \times 4) + (x \times 5) + (4 \times 5)$
$= x^2 + 4x + 5x + 20 = x^2 + 9x + 20$
9 Area $= (x \times x) + (x \times 5) + (x \times 5) + (5 \times 5)$
$= x^2 + 5x + 5x + 25 = x^2 + 10x + 25$
10 Area $= (x \times x) + (x \times 6) + (x \times 7) + (6 \times 7)$
$= x^2 + 6x + 7x + 42 = x^2 + 13x + 42$

Exercise 7.8

1 **a**), **b**) and **d**) are correct.

2 $10n - 4n$, $3n + 3n$, $3(n + n)$

3 **a)** $(3 + 5)^2 = 3^2 + 3 \times 10 + 25$
$8^2 = 9 + 30 + 25$
$64 = 64$

b) $(x + 5)^2 = (x + 5)(x + 5) = x^2 + 10x + 25$

Exercise 7.9

1 **a)** $3(a + 2)$ **b)** $3(3b + 4)$ **c)** $5(3 + 2c)$
d) $2(d - 2)$ **e)** $3(1 - 3e)$ **f)** $5(f - 1)$

2 **a)** $4(2a - 3)$ **b)** $6(5b - 4)$ **c)** $12(1 - 2c)$
d) $8(3d + 4)$ **e)** $4(2e - 1)$ **f)** $4(1 - 3f)$

3 **a)** $a(2b + 3)$ **b)** $a(b + 1)$ **c)** $6c(2d - 1)$
d) $8d(1 - 2c)$ **e)** $6f(4e - 5)$ **f)** $21f(2 - e)$

4 **a)** $a(a + 6)$ **b)** $b(b - 10)$ **c)** $c(6 + c)$
d) $d(2d - 1)$ **e)** $e(12e + 1)$ **f)** $f(f + 12)$
g) $x(2x + y)$ **h)** $y(y + 8)$ **i)** $g(f - 3g)$
j) $k(5j - 6k)$

Exercise 7.10

1 $3x$

2 **a)** $2l + 2w$ or $2(l + w)$
b) lw

3 **a)** $w + 5$ **b)** $4w + 10$ **c)** $w(w + 5)$

4 $T = 30n$

5 **a)** $12x$ **b)** $T = 12x + y$

6 $w = \dfrac{a}{l}$

7 **a)** $15x$ **b)** $T = 15x + 25y$

8 **a)** £15 **b)** $C = 5 + 2n$

Exercise 7.11

1 **a)** $a = b - 3$ **b)** $a = b - 7$ **c)** $a = b + 1$
d) $a = \dfrac{b}{2}$ **e)** $a = 4b$ **f)** $a = 3 - b$

2 **a)** $x = \dfrac{y - 1}{2}$ **b)** $x = \dfrac{y - 3}{2}$ **c)** $x = \dfrac{y + 1}{5}$
d) $x = 3y$ **e)** $x = 4(y - 5)$ **f)** $x = 2(y + 1)$

3 **a)** $c = \dfrac{y}{ab}$ **b)** $c = \dfrac{y - a}{2}$ **c)** $c = \dfrac{y + b}{a}$
d) $c = \dfrac{a}{y}$ **e)** $c = \dfrac{y - 2a}{b}$ **f)** $c = \dfrac{by}{a}$

4 **a)** $l = \dfrac{A}{w}$ **b)** $u = v - at$ **c)** $a = \dfrac{v - u}{t}$
d) $m = \dfrac{E}{c^2}$ **e)** $x = \dfrac{y - 3}{4}$ **f)** $b = \dfrac{V}{ac}$
g) $h = \dfrac{2A}{b}$ **h)** $m = \dfrac{y}{x - a}$ **i)** $m = \dfrac{y - c}{x}$
j) $c = y - mx$

Review Exercise 7

1 **a)** 7 **b)** 8 **c)** 3 **d)** 13
e) 2 **f)** 6 **g)** 16 **h)** 8

2 **a)** 24 **b)** 32 **c)** 10 **d)** -40

3 **a)** 18 **b)** -8 **c)** 36 **d)** 10

4 **a)** -1 **b)** 13 **c)** 10 **d)** 1

5 $2(n + n)$, $2n + 2n$, $2 \times 2n$

6 **a)** £7000 **b)** 9
c) $C = 1000(n + 3)$

7 **a)** $3x$ **b)** $x - 9$

8 **a)** $12x$ **b)** $12x + 10y$

9 **a)** $3a$ **b)** $4b$ **c)** $6c - 2$
d) $9c + d$ **e)** $7e^2$ **f)** $5f^2$

10 **a)** $8a + 12$ **b)** $4ab - b$
c) $3c^2 - 4c$ **d)** $8d - 12$

11 **a)** $7x + 16$ **b)** $5y + 13$ **c)** $13x + 5$
d) $2x - 16$ **e)** $8z - 7$ **f)** $10x - 14$

12 **a)** $2(2a + 1)$ **b)** $4(2b - 1)$ **c)** $4(3c + 2)$
d) $4c(2d - 5)$ **e)** $4e(3f - 8)$ **f)** $f(4f - 3)$
g) $2g(4g + 3)$ **h)** $15h(1 + 2h)$ **i)** $6i(4h - 3)$

13 **a)** $5a$ **b)** b^5 **c)** $5c$ **d)** $6cd$

14 **a)** $x + 6y$ **b)** $2y$ **c)** $4c^2$

15 **a)** **(i)** $3e + 2f$ **(ii)** $4e^2$
b) -14
c) $3a(2b - 1)$

16 **a)** $x + 4y$ **b)** n^2 **c)** $r + 2s$ **d)** $12ab$

17 **a)** **(i)** $8g$ **(ii)** $10rp$
b) $10y - 15$
c) $23 - 6x$

18 **a)** Bryani, since $4 \times 3^2 = 4 \times 9 = 36$
b) 64

19 **a)** -5 **b)** 73

20 **a)** a^3 **b)** b^5 **c)** c^4
d) d^5 **e)** e^{16} **f)** f^{10}
g) g^2 **h)** h **i)** i^4

21 **a)** $3x^6$ **b)** $5y^3$ **c)** $4z$
d) $15y^7$ **e)** $12x^5$ **f)** $3y^3$

22 **a)** $x^2 + 6x + 5$ **b)** $y^2 + 12y + 35$
c) $x^2 - x - 20$ **d)** $z^2 + 8z + 16$

23 $T = 26x + 19y$

24 $r = \dfrac{C}{2\pi}$

25 $l = \dfrac{P}{3}$

26 $w = \dfrac{P - 2l}{2}$

27 **a)** **(i)** $2(3x + 2)$
(ii) $3x(x - 2)$
(iii) $4x(2y + 1)$
b) **(i)** x^3 **(ii)** x^{10} **(iii)** $15x^2$
c) **(i)** $7x - 1$
(ii) $x^2 + 5x + 6$
(iii) $x^2 - 6x + 9$

28 **a)** $a(a + 2)$ **b)** $a = \dfrac{b + 1}{2}$ **c)** $x^2 + x - 6$

29 **a)** a^2 **b)** $15y^4$ **c)** $a = \dfrac{v - u}{t}$

30 **a)** £3.84 **b)** 56p

31 **a)** $2n$ **b)** $2n + 15$ **c)** $20q$

32 **a)** 30 **b)** 65

33 **a)** $6x$ **b)** $12(x - 4)$ **c)** $18x - 48$

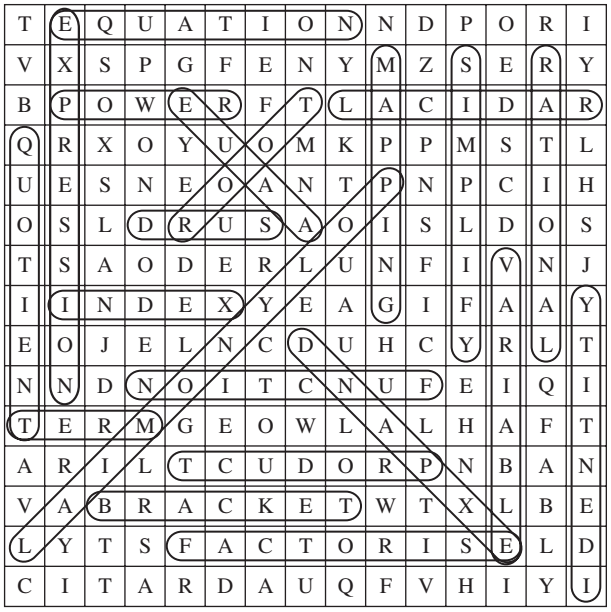
34 **a)** y^7 **b)** $8x + 17$
c) $2(2a + 3)$ **d)** $3p(2p - 3q)$

35 **a)** **(i)** 2 **(ii)** 4 **(iii)** 64 **(iv)** 200
b) **(i)** even **(ii)** odd

36 **a)** **(i)** 13 **(ii)** 17 **(iii)** 23
(iv) 53 **(v)** 121
b) No, 121 is not a prime number: $11 \times 11 = 121$.

37 **a)** $x + 15$ **b)** $P = 4x + 70$
c) $x = \dfrac{P - 70}{4}$ **d)** 5

Internet Challenge 7



Chapter 8: Equations

Starter 8

Clockwise from lower left:

2 (8) [13] (5) [14] (9) [17]
3 (3) [12] (9) [16] (7) [10]
4 (6) [13] (7) [17] (10) [16]

Exercise 8.1

1 A, C
2 E, F, G, I
3 B, J
4 D: $x + x \equiv 2x$; H: $x + x + x \equiv 3x$

Exercise 8.2

1 a) $a = 6$ **b)** $b = 60$ **c)** $c = 7$
2 a) $a = 8$ **b)** $b = 30$ **c)** $c = 17$
3 a) $a = 8$ **b)** $b = 10$ **c)** $c = 3$
4 a) $a = 15$ **b)** $b = 6$ **c)** $c = 18$
5 a) $x = 7$ **b)** $x = 9$ **c)** $x = -9$
d) $x = 30$ **e)** $x = 2$ **f)** $x = 10$
g) $x = 4$ **h)** $x = 12$ **i)** $x = 8$
6 a) $t = 16$ **b)** $u = -3$ **c)** $p = \frac{1}{2}$
d) $g = \frac{1}{3}$ **e)** $q = \frac{1}{4}$ **f)** $w = -2$
g) $y = 0.4$ **h)** $h = 3$ **i)** $z = -7$

Exercise 8.3

1 a) $a = 4$ **b)** $b = 1$ **c)** $c = 3$
d) $d = 1$ **e)** $e = 2$ **f)** $f = 5$
g) $g = 2$ **h)** $h = 1$ **i)** $i = 4$
2 a) $a = 6$ **b)** $b = 9$ **c)** $c = 6$
d) $d = 2$ **e)** $e = 2$ **f)** $f = 3$
g) $g = 2$ **h)** $h = 4$ **i)** $i = 0$
3 a) $a = 0.5$ **b)** $b = 0.75$ **c)** $c = 0$
d) $d = -1$ **e)** $e = -2$ **f)** $f = -2$
g) $g = -3$ **h)** $h = 0.4$ **i)** $i = 0.25$
4 a) $a = 9$ **b)** $b = 2$ **c)** $c = 8$
d) $d = 19$ **e)** $e = 5$ **f)** $f = 6$
g) $g = -2$ **h)** $h = 12$ **i)** $i = 0.5$

Exercise 8.4

1 $a = 1$ **2** $b = 2$ **3** $c = 6$
4 $d = 3$ **5** $e = 2$ **6** $f = -2$
7 $g = 0.25$ **8** $h = -3$ **9** $i = 7$
10 $j = 0.5$ **11** $k = 1.5$ **12** $l = 0$

Exercise 8.5

1 $x = 3$ **2** $x = 1$ **3** $x = 4$
4 $x = 3$ **5** $x = 3$ **6** $x = 5$
7 $x = 2$ **8** $x = -2$ **9** $x = 0$
10 $x = 11$ **11** $x = 7$ **12** $x = 7$
13 $x = 2$ **14** $x = 6$ **15** $x = 10$
16 $x = 4$ **17** $x = 4$ **18** $x = 3$
19 $x = -4$ **20** $x = 4$

Exercise 8.6

1 $x = \pm 2$ **2** $x = \pm 6$
3 $x = \pm 12$ **4** $x = \pm 4$
5 $x = \pm 15$ **6** $x = \pm 1$
7 $x = \pm 3$ **8** $x = \pm 11$
9 $x = \pm 4$ **10** $x = \pm 9$
11 $x = \pm 3$ **12** $x = \pm 13$
13 $x = \pm 6$ **14** $x = \pm 8$
15 $x = \pm 12$ **16** $x = \pm 14$

Exercise 8.7

1 a) $6c$ **b)** $6c = 66$ **c)** £11
2 a) $3x$ **b)** $3x = 48$ **c)** 16 cm
3 a) $c + 2$ **b)** $3(c + 2)$
c) $3(c + 2) = 12$ **d)** $c = 2$
4 a) (i) $2n + 4 = 20$ **(ii)** $n = 8$
b) (i) $m + 4$ **(ii)** $3(m + 4)$
(iii) $3(m + 4) = 18$ **(iv)** $m = 2$
5 a) $w + 6$
b) (i) $w + (w + 6) + w + (w + 6)$
(ii) $4w + 12$
c) 4 cm
6 a) $2w$
b) (i) $w + 2w + w + 2w$
(ii) $6w$
c) 8 cm
7 a) y^2 **b)** 13 cm
8 a) (i) $2x - 3 + x + 2x - 3 + x$
(ii) $6x - 6$
b) (i) $2x + 2x + x + 1$
(ii) $5x + 1$
c) (i) $6x - 6 = 5x + 1$
(ii) 7 cm
9 a) $2(n + 12)$
b) $4n = 2(n + 12)$
c) $n = 12$
10 a) $7n + 5 = 5(n + 7)$
b) $n = 15$

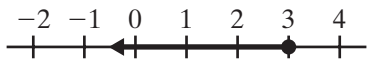
Exercise 8.8

1 $x = 4.3$ **2** $x = 1.4$ **3** $x = 1.8$
4 $x = 4.5$ **5** $x = 3.1$ **6** $x = 3.37$
7 $x = 1.64$ **8** $x = 4.06$ **9** $x = 1.30$
10 a) when $x = 0$, $3x^2 - x - 1 = -1$: too small
when $x = 1$, $3x^2 - x - 1 = 1$: too big
b) $x = 0.77$
c) $x = -0.43$

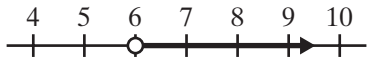
Exercise 8.9

1 **a)** $3 < 5$ **b)** $2.1 < 2.2$ **c)** $7 > 4.1$
d) $3.3 > 3.2$ **e)** $-2 < 0$ **f)** $-3 > -5$
g) $-7 < -6$ **h)** $-2.2 > -2.3$ **i)** $-4 < -3.9$

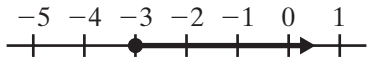
2 **a)**



b)



c)



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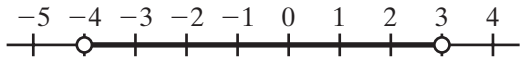

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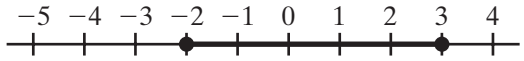

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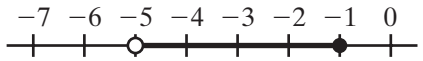


3 **a)** $-1, 0, 1, 2, 3, 4, 5$ **b)** $-6, -5, -4, -3, -2$
c) $3, 4, 5, 6$ **d)** $3, 4, 5, 6, 7$
e) $-2, -1, 0, 1, 2$ **f)** $-1, 0, 1, 2, 3$

4 **a)** $x < 2$ **b)** $x > 12$ **c)** $x \geqslant 3$
d) $x \geqslant 5$ **e)** $x \leqslant 3$ **f)** $x < 5$

5 **a)** $-2 < x < 4$ **b)** $5 \leqslant x < 11$ **c)** $2 < x \leqslant 4$
d) $-2 \leqslant x \leqslant 1$ **e)** $-4 \leqslant x \leqslant 1$ **f)** $-2 \leqslant x < 3$

6 **a)** 1, 2, 3 **b)** 0, 1, 2, 3 **c)** $-1, 0$
d) 0, 1, 2 **e)** 0, 1, 2 **f)** $-1, 0, 1, 2, 3$

Review Exercise 8

1 **a)** formula **b)** expression
c) equation **d)** identity

2 **a)** $x = 6$ **b)** $y = -2$ **c)** $x = 7$ **d)** $y = 0.5$
e) $x = 5$ **f)** $z = 20$ **g)** $x = 4$ **h)** $x = 5$
i) $x = 3$ **j)** $y = 2$

3 **a)** $a = 3$ **b)** $b = 2$ **c)** $c = 3$

4 **a)** $a = 3$ **b)** $b = 7$ **c)** $c = 5$

5 **a)** $x = 4$ **b)** $-3, -2, -1, 0, 1, 2$

6 **a)** 2, 3, 4 **b)** $-1, 0, 1, 2$
c) $-2, -1, 0, 1, 2$ **d)** $-1, 0, 1$

7 **a)** $n \leqslant 2$ **b)** $n > 1$ **c)** $-2 \leqslant n \leqslant 4$

8 **a)** $p = 3$ **b)** $q = -2$ **c)** $x = 42$

9 **(i)** $11 < x + x + 3 + 3 + < 20$
$11 < 2x + 6 < 20$
$5 < 2x < 14$
(ii) 3, 4, 5, 6

10 **a)** $y = \pm 12$ **b)** $y = \pm 6$ **c)** $y = \pm 3$

11 **a)** $x = 4$ **b)** $x = 4$ **c)** $x = 2$
d) $x = -1.5$ **e)** $x = 3$ **f)** $x = 5$
g) $x = -2$ **h)** $x = 0$ **i)** $x = 1$

12 **a)** $y = 4$ **b)** $x = 9$
c) $x = 0$ **d)** $z = -1$

13 $x = 3.3$ **14** $x = 2.31$

15 **a)** $x = 4$; $x^2 - x = 12$: too small;
$x = 5$; $x^2 - x = 20$: too big
b) $x = 4.8$

16 **a)** $x = 1.62$ **b)** $x = -0.62$

17 $5(2x - 1) - 2(x + 4) = 19$
$10x - 5 - 2x - 8 = 19$
$8x - 13 = 19$
$8x = 32$
$x = 4$

18 $3(2 \times (-1) - 1) + 4(-1 + 8)$
$= 3 \times -3 + 4 \times 7$
$= -9 + 28 = 19$ So Emily is right.

19 **a)** $y = 4$ **b)** $x = 8$ **20** 9

21 **a)** $P = 4x + 8$ **b)** 11.5 cm **22** $x = 3.3$ **23** 23

Internet Challenge 8

1 German
2 Branuschweig, 30 April 1777
3 77 years
4 Construction of the heptadecagon.
5 He added them in pairs: $1 + 100$, $2 + 99$, ... gives $101 \times 50 = 5050$.
6 Göttingen
7 He discovered Ceres, the first known asteroid.
8 A polynomial of degree n will have exactly n solutions. For example, the equation $x^3 + 4x^2 + x - 6 = 0$ is of degree 3 (it has an x^3 term) and has 3 solutions. Note that some of the solutions may be duplicates, and some may only exist if you use complex numbers (which were also developed by Gauss).
9 Demagnetise it.
10 When told his wife was dying.
11 The prince of mathematicians.
12 1855, Göttingen
13 Heptadecagon. No.
14 A heptadecagon has 17 sides.

Chapter 9: Number sequences

Starter 9

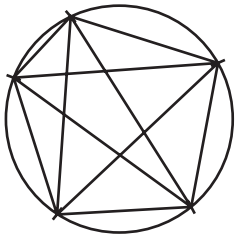
Task 1
The number of points increases by 1 each time.
There is always the same number of points as the pattern number.
So, for pattern number n, the number of points is also n.

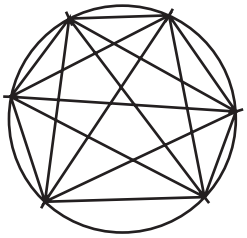
Task 2
The number of lines increases by 1, then 2, then 3, and so on.
This task is related to the triangular numbers, though students are unlikely to recognise them at this stage.
The rule is: $\frac{n(n-1)}{2}$
So when $n = 4$, there are $\frac{4 \times 3}{2} = 6$ lines
This rule works because each point is joined to $n - 1$ other points.
So there are $n \times (n - 1)$ lines.
Since each line has two ends, this means that each line is counted twice.
So in fact there are $\frac{n(n-1)}{2}$ lines.

Task 3
The number of regions appears to double each time.
Again, students will not be expected to recognise powers of 2 at this stage – although the rule appears to be 2^{n-1}

Task 4
In pattern 5 there should be: 5 points, 10 lines, 16 regions.
In pattern 6 there should be: 6 points, 15 lines, 32 regions.

Check:





The rules for lines and points work for pattern 6. However, there are only 31 regions, so the rule for regions breaks down.

Exercise 9.1

1 a)

Pattern 4

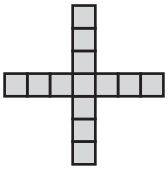
b)

Pattern number	1	2	3	4	5
Number of matches	4	7	10	13	16

c) Add 3 to the number of matches in pattern 5, so $16 + 3 = 19$

d) 46

2 a)



Pattern 4

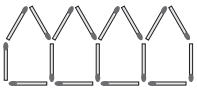
b)

Pattern number	1	2	3	4	5
Number squares	1	5	9	13	17

c) Add 4 to the number of squares in pattern 5, so $17 + 4 = 21$

d) 57

3 a)



Hut 4

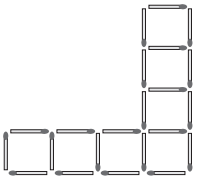
b)

Hut number	1	2	3	4	5
Number of matches	5	9	13	17	21

c) 41

d) No. The number of matches is always odd.

4 a)



Pattern 4

b)

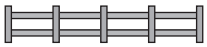
Pattern number	1	2	3	4	5
Number of matchsticks	4	10	16	22	28
Number of squares	1	3	5	7	9

c) (i) Add 6 to number of matchsticks in pattern 5

(ii) Add 2 to number of squares in pattern 5

d) (i) 118 **(ii)** 39

5 a)



Fence 4

b)

Fence number	1	2	3	4	5	10	20
No. of uprights	2	3	4	5	6	11	21
No. of crossbars	2	4	6	8	10	20	40

c) Fence 49 **d)** Fence 25

Worksheet 9.1

1 a) Every 4th circle is red; every 5th circle blue

b) The RED sequence gives the multiples of 4

c) The BLUE sequence gives the multiples of 5

d) 20 and 40. They have 4 and 5 as factors.

2 a) New red sequence: 5, 9, 13, 17, ...
New blue sequence: 6, 11, 16, 21, ...

b) Every 4th circle is red starting at 5; every 5th circle is blue starting at 6

c) Red sequence 1 more than multiples of 4; blue sequence 1 more than multiples of 5.

3 a) Green sequence multiples of 6; yellow sequence multiples of 3.

b) New green sequence: 7, 13, 19, 25, ...
New yellow sequence: 4, 7, 10, 13, ...

c) Green sequence 1 more than multiples of 6; yellow sequence 1 more than multiples of 3.

4 Students' own sequences.

Exercise 9.2

1 a) 7, 11, 15, 19, 23 **b)** 1, 3, 9, 27, 81

c) 30, 25, 20, 15, 10 **d)** 128, 64, 32, 16, 8

e) 8, 5, 2, −1, −4 **f)** 2, 4, 8, 16, 32

g) 3, 7, 15, 31, 63

2 a) (i) 13, 15

(ii) First term is 3. To find next term add 2 to the previous term.

b) (i) 34, 40

(ii) First term is 4. To find next term add 6 to the previous term.

c) (i) 14, 12

(ii) First term is 24. To find next term subtract 2 from previous term.

d) (i) 12, 6

(ii) First term is 42. To find the next term subtract 6 from previous term.

e) (i) 48, 96

(ii) First term is 3. To find the next term double previous term.

f) (i) −10, −14

(ii) First term is 10. To find the next term subtract 4 from previous term.

3 a) 5, 9, 11 **b)** 2, 10, 12 **c)** 26, 29, 41

d) 38, 36, 28 **e)** 0, 3, 6 **f)** 8, 0, −4

4 a) (i) 36

(ii) Add on 11 to 25 as differences are increasing by the odd numbers.

b) (i) 32

(ii) Each term is double the previous term.

c) **(i)** 21
(ii) Add on 6 to 15 as differences are increasing by 1 each time.
d) **(i)** 63
(ii) Double previous term and add 1.
e) **(i)** 13
(ii) Add together previous 2 terms.
f) **(i)** 32
(ii) Halve previous term.

5 **a)** 26, 31, 36
b) Add 5 to previous term.
c) 251
d) No. All terms end in a '1' or a '6'.

6 **a)** 27, 30, 33
b) First term is 12. To find next term add 3 to previous term.

7 The rule for even numbers is 'First term is 2. To find the next term +2 to previous term'.

8 **a)** 16, 19, 22
b) Add 3 to previous term.
c) 151
d) No. 99 is in 3 times table. Sequence misses '3 times table' as it starts at 1 and increases by 3 each time.

9 **a)** 26, 30, 34
b) Add 4 to previous term.
c) 406
d) No. 100 is in 4 times table. Sequence misses '4 times table' as it starts at 6 and increases by 4 each time.

Exercise 9.3

1 **a)** 2, 4, 6, 8, 10 **b)** 3, 6, 9, 12, 15
c) 4, 8, 12, 16, 20 **d)** 2, 3, 4, 5, 6
e) 4, 5, 6, 7, 8 **f)** −3, −2, −1, 0, 1
g) 1, 3, 5, 7, 9 **h)** 4, 7, 10, 13, 16

2 **a)** 7, 15, 23, 31, 39 **b)** 159 **c)** 30

3 **a)** 2, 3.5, 5, 6.5, 8, 9.5
b) 35 **c)** 17

4 **a)** 1, 4, 9, 16, 25 **b)** 0, 3, 8, 15, 24
c) 1, 8, 27, 64, 125 **d)** 0, 4, 18, 48, 100

5 **a)** 1, 3, 6, 10, 15 **b)** 465

Worksheet 9.3

1 $2 \times 4 + 1 = 8 + 1 = 9$
$2 \times 5 + 1 = 10 + 1 = 11$
$2 \times 6 + 1 = 12 + 1 = 13$
$2 \times 7 + 1 = 14 + 1 = 15$
$2 \times 8 + 1 = 16 + 1 = 17$ etc.
$2 \times n + 1 = 2n + 1 =$ Value

2 **a)** Crosses on graph at values in answer 1
b) The values go up by 2 each time.

3 $3 \times 4 + 1 = 12 + 2 = 14$
$3 \times 5 + 1 = 15 + 2 = 17$
$3 \times 6 + 1 = 18 + 2 = 20$ etc
$3 \times n + 1 = 3n + 2 =$ Value

4 **a)** Crosses on graph at values in answer 3
b) The values go up by 3 each time.

5 **a)** The values go up by 3 each time.
$3n - 2 =$ Value
b) The values go up by 2 each time.
$2n + 5 =$ Value

Exercise 9.4

1 **a)** $2n$ **b)** $4n$ **c)** $7b$
d) n **e)** $10n$ **f)** $15n$

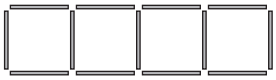
2 **a)** $2n + 1$ **b)** $2n - 1$ **c)** $3n + 1$
d) $4n + 1$ **e)** $6n - 5$ **f)** $8n - 6$

3 **a)** $10 - 2n$ **b)** $11 - n$
c) $18 - 3n$ **d)** $22 - 4n$

4 **a)** 57 **b)** $5n + 7$

5 **a)** −6 **b)** $66 - 8n$

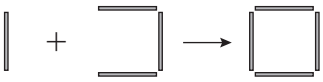
6 **a)**



Pattern 4

b) 19
c) $S = 3n + 1$
d) 3 sticks are added to make the next pattern:

The first pattern is made by '1' stick plus another 3.



7 **a)** 7 **b)** 2 **c)** $7n - 5$
d) $7 \times 5 - 5 = 30$ ✓ $7 \times 6 - 5 = 37$ ✓

Exercise 9.5

1 **a)**

Pattern 5

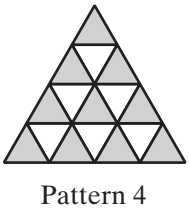
b)

Pattern number	1	2	3	4	5
Number of triangles	1	3	5	7	9

c) 13 **d)** $T = 2n - 1$

2 **a)** **(i)** 36, 49 **(ii)** 100 **(iii)** n^2
b) **(i)** 37, 50 **(ii)** 101 **(iii)** $n^2 + 1$
c) **(i)** 35, 48 **(ii)** 99 **(iii)** $n^2 - 1$
d) **(i)** 42, 55 **(ii)** 106 **(iii)** $n^2 + 6$
e) **(i)** 136, 149 **(ii)** 200 **(iii)** $n^2 + 100$
f) **(i)** 33, 46 **(ii)** 97 **(iii)** $n^2 - 3$

3 **a)**



Pattern 4

b)

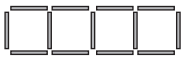
Pattern number	1	2	3	4	5
No. of red triangles	1	3	6	10	15
No. of green triangles	0	1	3	6	10
Total no. of triangles	1	4	9	16	25

c) 100
d) $T = n^2$

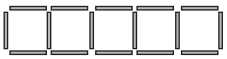
4 **a)** **(i)** 12 **(ii)** 20 **(iii)** 30
b) **(i)** 6 **(ii)** 10 **(iii)** 15
c) **(i)** 110 **(ii)** 55
(iii) $n \times (n + 1)$ **(iv)** $\frac{n \times (n + 1)}{2}$

Worksheet 9.5

1



Shape 4
13 sticks



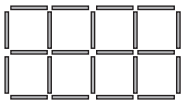
Shape 5
16 sticks

2

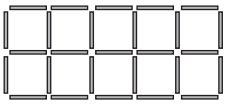
Shape	Squares	Outside edges
1	1	4
2	2	6
3	3	8
4	4	10
5	5	12

3 a) Squares increase by 1 through the sequence.
b) Outside edges increase by 2 through the sequence.

4



Shape 4



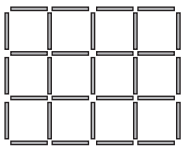
Shape 5

5

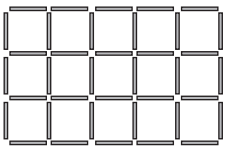
Shape	Squares	Outside edges
1	2	6
2	4	8
3	6	10
4	8	12
5	10	14
6	12	16
7	14	18
8	16	20

6 a) Squares increase by 2 through the sequence starting from 2.
b) Outside edges increase by 2 through the sequence starting from 6.

7



Shape 4



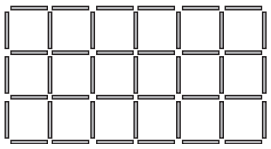
Shape 5

8

Shape	Squares	Outside edges
1	3	8
2	6	10
3	9	12
4	12	14
5	15	16
6	18	18
7	21	20
8	24	22
9	27	24
10	20	26

9 a) Squares increase by 3 through the sequence starting from 3.
b) Outside edges increase by 2 through the sequence starting from 8.

10 Yes



Review Exercise 9

1 a) 11, 13, 15 **b)** 20, 23, 26 **c)** 32, 64, 128
d) 47, 76, 123 **e)** 16, 22, 29 **f)** 30, 28, 26
g) 100 000, 1 000 000, 10 000 000 **h)** 36, 49, 64

2 a) 2, 7, 12, 17, 22 **b)** 1, 9, 17, 25, 33
c) 15, 12, 9, 6, 3

3 a) 5, 10, 15, 20, 25 **b)** 7, 14, 21, 28, 35
c) 0, 1, 2, 3, 4 **d)** 5, 6, 7, 8, 9
e) 6, 7, 8, 9, 10 **f)** $-1, 0, 1, 2, 3$

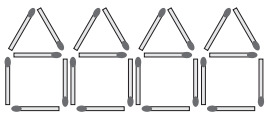
4 a) 1, 3, 5, 7, 9 **b)** 5, 8, 11, 14, 17
c) 1, 5, 9, 13, 17 **d)** 6, 11, 16, 21, 26
e) 3, 9, 15, 21, 27 **f)** 0, 7, 14, 21, 28
g) $-2, 1, 6, 13, 22$ **h)** 5, 8, 13, 20, 29

5 a) $3n$ **b)** $7n$ **c)** $8n$
d) $2n + 1$ **e)** $6n + 4$ **f)** $8n - 4$
g) $11n + 11$ **h)** $10 - n$ **i)** n^2
j) $n^2 + 2$

6 a) 16, 19, 22 **b)** Add 3 to previous term
c) 151
d) No. 300 is a multiple of 3, sequence misses multiples of 3 as it starts at 1 and goes up by 3 each time.

7 a) 26 **b)** 61 **c)** $5n + 1$

8 a)



Pattern 4

b) Point at (4, 24) on graph
c) 60 **d)** $m = 6n$

9 a) 260, 254 **b)** Subtract 6 from previous term
c) 170

10 a) 28, 33 **b)** Add 5 to previous term
c) All terms end in 8 or 3.

11 a) (i) 5 **(ii)** 39
b) $100 \times 2 - 1$
c)

Pattern 4

d)

Pattern number	1	2	3	4	5
Number of dots	5	8	11	14	17

12 a) (i) 8 **(ii)** 22
b) 200×2
c)

d)

Pattern number	1	2	3	4	5
Number of crosses	6	10	14	18	22

13 a)

Pattern 4

b)

Pattern number	1	2	3	4	5
Number of dots	8	12	16	20	24

c) 44 **d)** $d = 4n + 4$

14 a) 15, 9 **b)** $4n - 3$

15 $5n + 1$

Worksheet 9R

NUMBER SEQUENCES
PATTERN; NUMBER SEQUENCE; FORMULA
PATTERNS; RULE
ODD; EVEN NUMBERS
SQUARE; CUBE; TRIANGLE NUMBERS
ANSWER; QUESTION; TIMES TABLE
TERM; NEXT, COMMON DIFFERENCE; POSITIVE; NEGATIVE

Internet Challenge 9

3 The value of each successive Fibonacci number divided by the number before it gets increasingly close to 1.6180, which is the Golden Ratio.
4 Various parts of the Parthenon are rectangles with sides in the Golden Ratio.
5 Leonardo da Vinci
6 Seurat
7 Born 1170
8 Died 1250
9 Yes, for example Binet's formula

$$\frac{(1+\sqrt{5})^n \times (1 \times \sqrt{5})^n}{2^n\sqrt{5}}$$

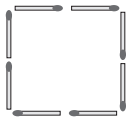
10 Nautilus

Chapter 10: Coordinates and graphs

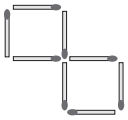
Starter 10

Task 1

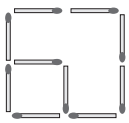
a)



b)



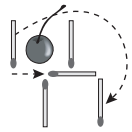
c)



Task 2

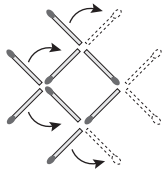
a)

b)

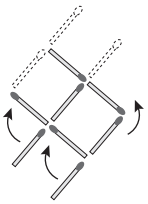


Task 3

a)



b)



Task 4

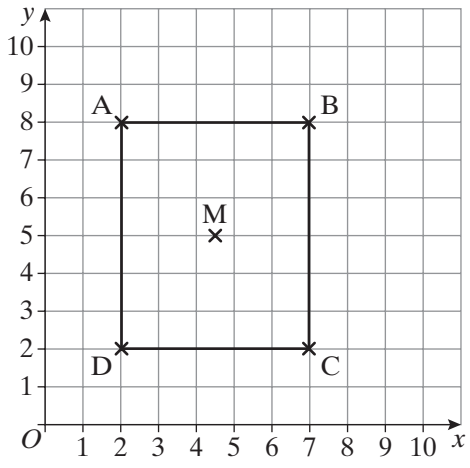
Exercise 10.1

1 A (5, 9) B (2, 8)
C (8, 7) D (7, 5)
E (3, 4) F (0, 2)
G (5, 1) H (9, 0)

2 A $(1, 4\frac{1}{2})$ B $(4\frac{1}{2}, 4)$
C $(1\frac{1}{2}, 2\frac{1}{2})$ D $(3, 2\frac{1}{2})$
E $(0, 1\frac{1}{2})$ F $(2, 1\frac{1}{2})$
G $(3\frac{1}{2}, \frac{1}{2})$ H $(\frac{1}{2}, 0)$

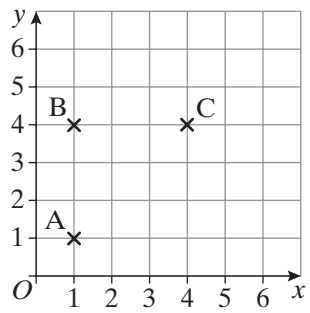
3 a) A (1, 8) B (7, 2)
b) (4, 5)

4 a), b)



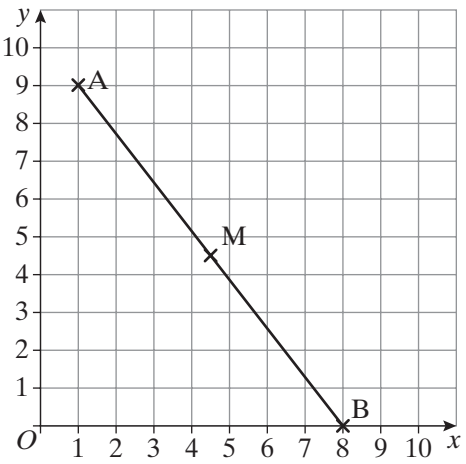
c) Rectangle
d) M $(4\frac{1}{2}, 5)$

5 a), b)



b) D at (4, 1)

6 a), b)



c) $(4\frac{1}{2}, 4\frac{1}{2})$

7 M (7, 5)

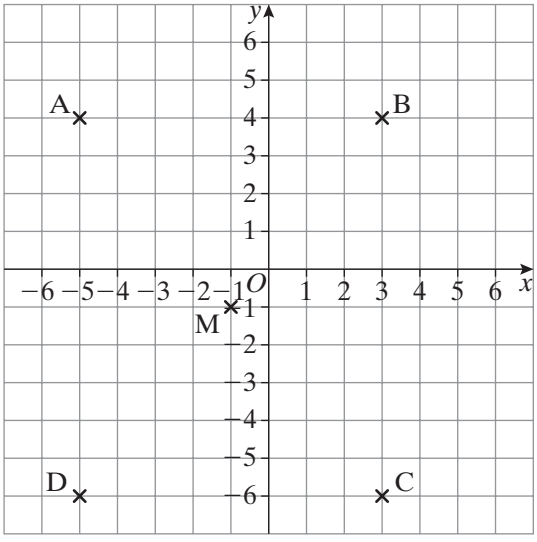
8 M $(3\frac{1}{2}, 7)$

Exercise 10.2

1 A (1, 2), B (−1, −2), C (−2, 3), D (3, −2), E (−4, −1)

2 a) M **b)** (−5, −2)
c) K **d)** (6, −1)
e) N **f)** D
g) J

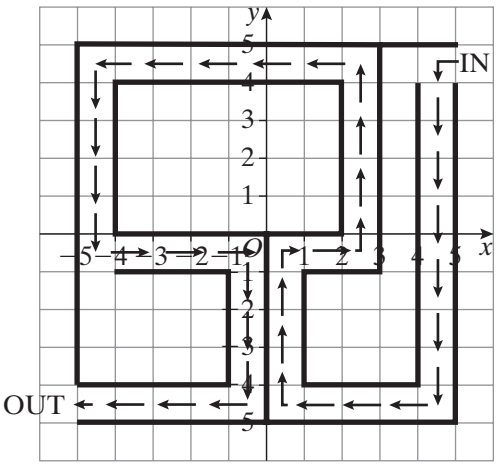
3 a), b)



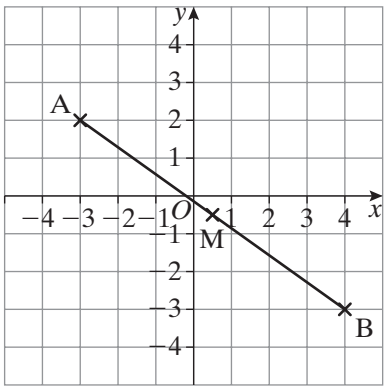
b) D (−5, −6)

c) M (−1, −1)

4

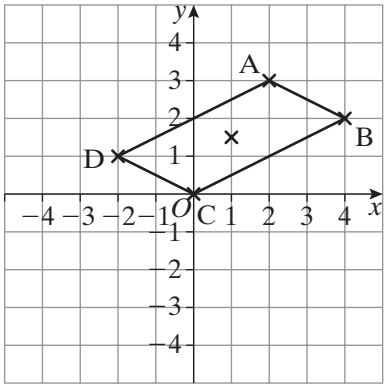


5 a), b)



c) M $(\frac{1}{2}, -\frac{1}{2})$

6 a), b)



c) Parallelogram **d)** $(1, 1\frac{1}{2})$

7 M (0, 5)

8 M (1, 3)

Exercise 10.3

1 A (0, 0, 0), B (2, 0, 0), C (0, 0, 2), D (2, 0, 2), E (0, 2, 0), F (2, 2, 0), G (0, 2, 2), H (2, 2, 2)

2 A (0, 0, 0), B (2, 0, 0), C (0, 0, 3), D (2, 0, 3), E (0, 4, 0), F (2, 4, 0), G (0, 4, 3), H (2, 4, 3)

3 A (0, 0, 0), B (5, 0, 0), C (0, 0, 2), D (5, 0, 2), E (0, 3, 0), F (5, 3, 0), G (0, 3, 2), H (5, 3, 2)

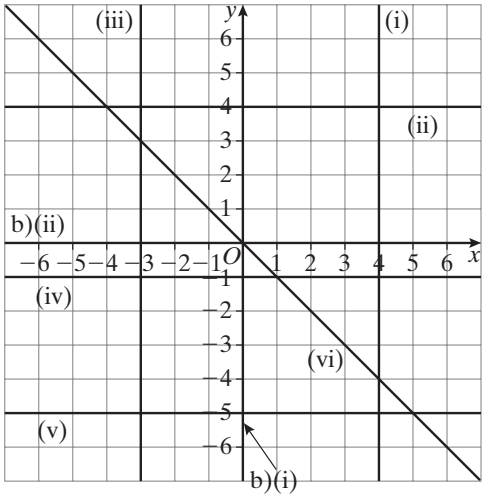
4 A (0, 0, 0), B (4, 0, 0), C (0, 0, 5), D (4, 0, 5), E (0, 2, 0), F (4, 2, 0), G (0, 2, 5), H (4, 2, 5)

5 A (0, 0, 0), B (3, 0, 0), C (0, 0, 5), D (3, 0, 5), E (0, 4, 0), F (3, 4, 0), G 0, 4, 5), H (3, 4, 5)

Exercise 10.4

1 a) $x = 3$ **b)** $y = 2$
c) $x = -2$ **d)** $y = -1$
e) $y = x$

2 a), b)

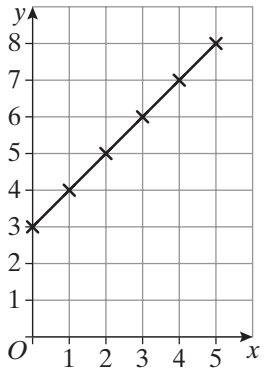


c) (i) *y* axis **(ii)** *x* axis

3 a)

x	0	1	2	3	4	5
y	3	4	5	6	7	8

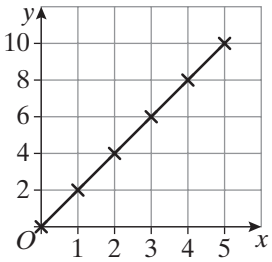
b)



4 a)

x	0	1	2	3	4	5
y	0	2	4	6	8	10

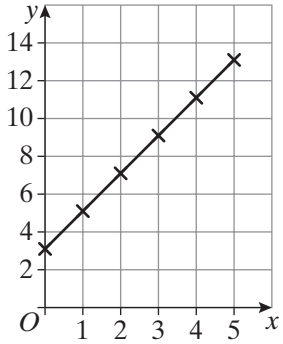
b)



5 a)

x	0	1	2	3	4	5
y	3	5	7	9	11	13

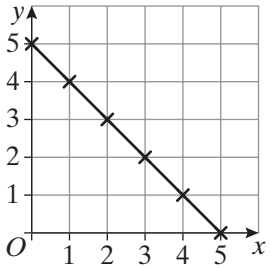
b)



6 a)

x	0	1	2	3	4	5
y	5	4	3	2	1	0

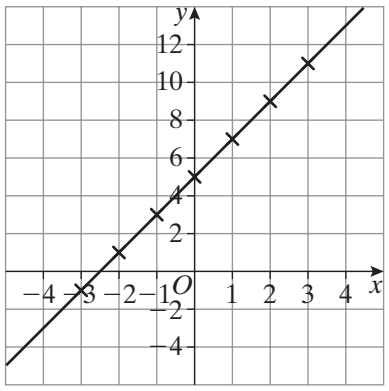
b)



7 a)

x	−3	−2	−1	0	1	2	3
y	−1	1	3	5	7	9	11

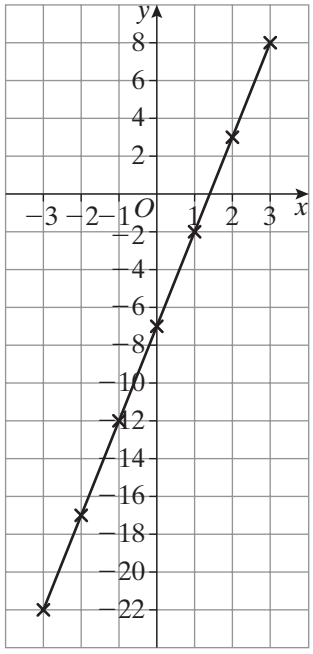
b)



8 a)

x	−3	−2	−1	0	1	2	3
y	−22	−17	−12	−7	−2	3	8

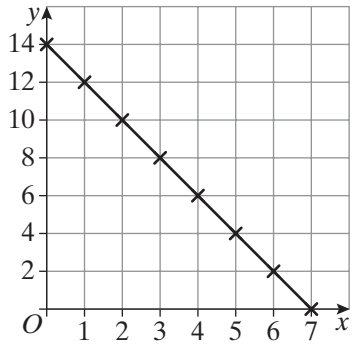
b)



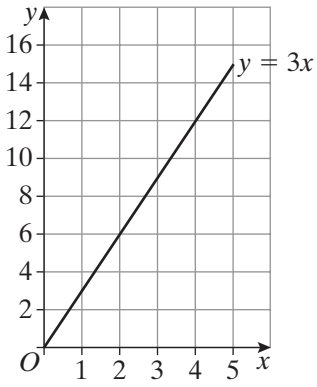
9 a)

x	0	1	2	3	4	5	6
2*x*	0	2	4	6	8	10	12
y	14	12	10	8	6	4	2

b)

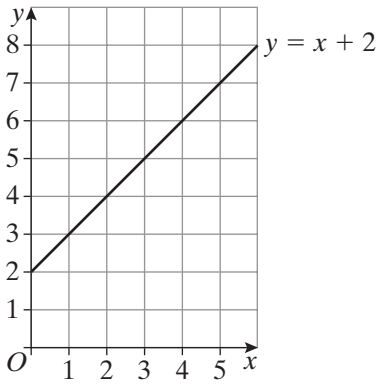


10 a), b)



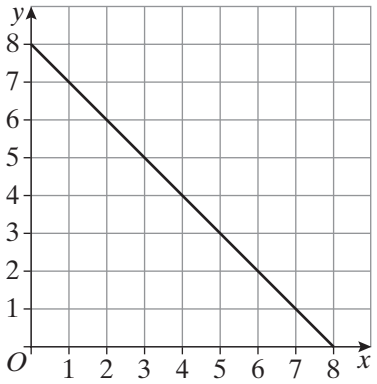
c) (i) $y = 3.9$ **(ii)** $x = 1.6$

11 a), b)



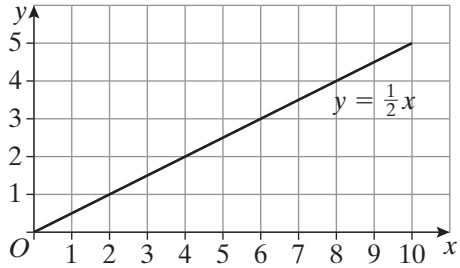
c) (i) $y = 4.7$ **(ii)** $x = 1.1$

12 a), b)

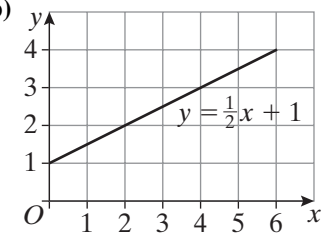


c) (i) $y = 2.1$ **(ii)** $x = 6.3$

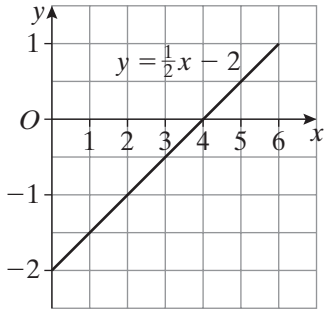
13 a)



b)



c)



Exercise 10.5

1 3 **2** 1 **3** -2 **4** $\frac{1}{2}$

5 $\frac{3}{4}$ **6** $-\frac{2}{3}$ **7** $\frac{1}{2}$ **8** $-\frac{1}{2}$

Exercise 10.6

1 a) 3 **b)** 4 **c)** -5 **d)** 2 **e)** 1 **f)** -3

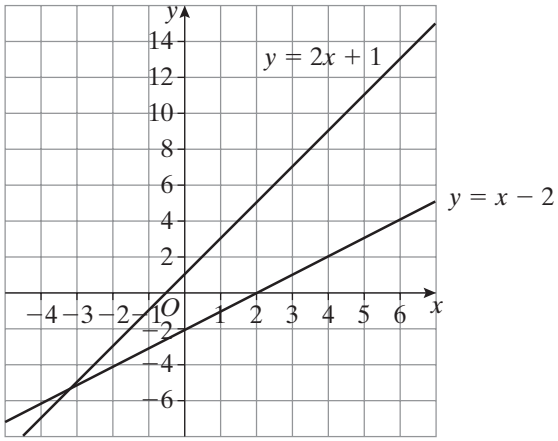
2 a) P (2, 2) Q (8, 5) **b)** gradient $\frac{1}{2}$, intercept 1

c) $y = \frac{1}{2}x + 1$

3 a) gradient $-\frac{1}{2}$, intercept 5 **b)** $y = -\frac{1}{2}x + 5$

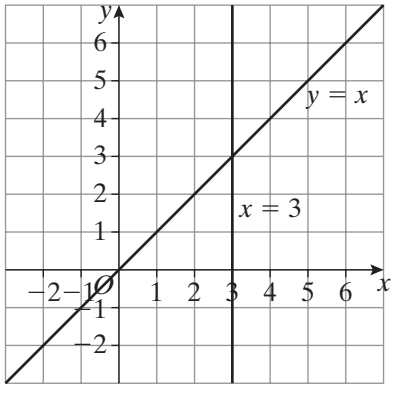
Exercise 10.7

1 a)



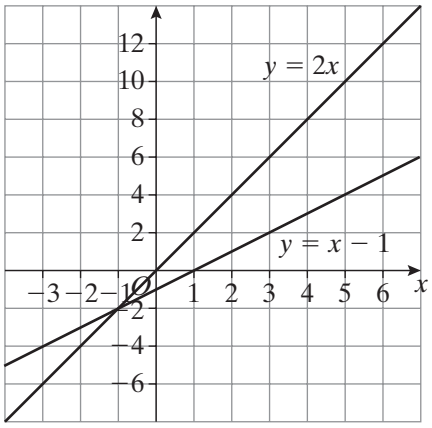
b) $(-3, -5)$ **c)** $x = -3, y = -5$

2 a)



b) (3, 3) **c)** $x = 3, y = 3$

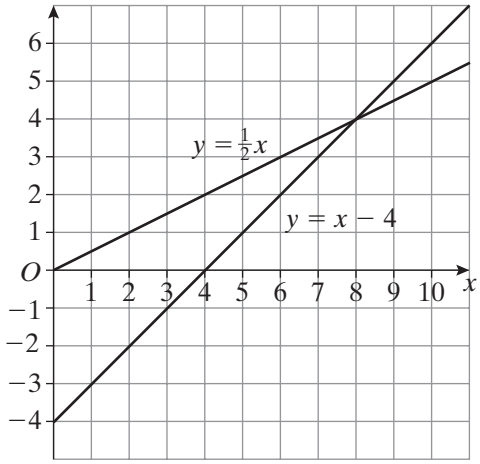
3 a)



b) (−1, −2)

c) $x = -1$, $y = -2$

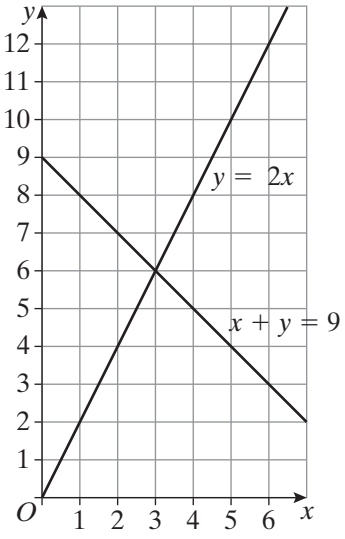
4 a)



b) (8, 4)

c) $x = 8$, $y = 4$

5 a)



b) (3, 6)

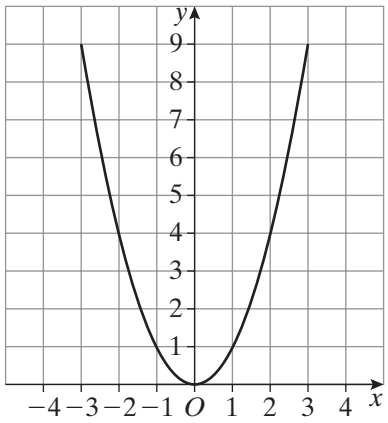
c) $x = 3$, $y = 6$

Exercise 10.8

1 a)

x	−3	−2	−1	0	1	2	3
x^2	9	4	1	0	1	4	9
y	9	4	1	0	1	4	9

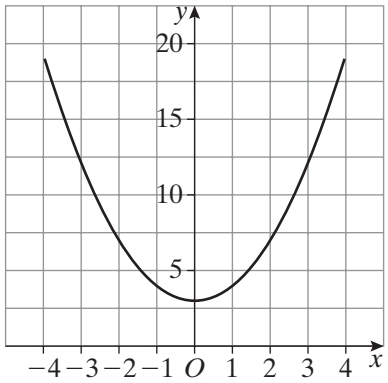
b)



2 a)

x	−4	−3	−2	−1	0	1	2	3	4
x^2	16	9	4	1	0	1	4	9	16
+3	+3	+3	+3	+3	+3	+3	+3	+3	+3
y	19	12	7	4	3	4	7	12	19

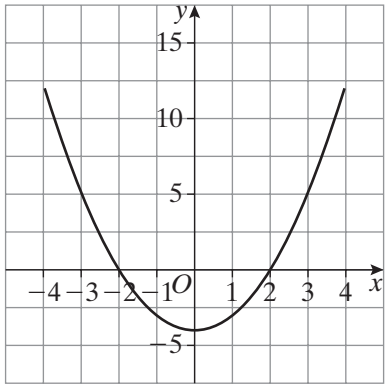
b)



3 a)

x	−4	−3	−2	−1	0	1	2	3	4
x^2	16	9	4	1	0	1	4	9	16
−4	−4	−4	−4	−4	−4	−4	−4	−4	−4
y	12	5	0	−3	−4	−3	0	5	12

b)

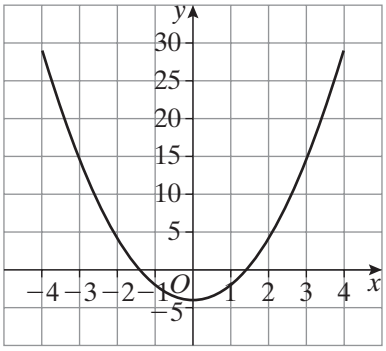


c) $x = \pm 2$

4 a)

x	−4	−3	−2	−1	0	1	2	3	4
x^2	16	9	4	1	0	1	4	9	16
$2x^2$	32	18	8	2	0	2	8	18	32
-4	−4	−4	−4	−4	−4	−4	−4	−4	−4
y	28	14	4	−2	−4	−2	4	14	28

b)

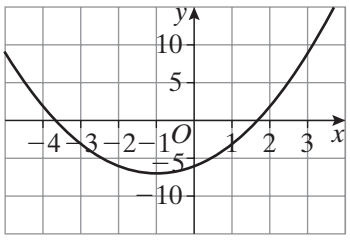


c) $x = \pm 1.4$

5 a)

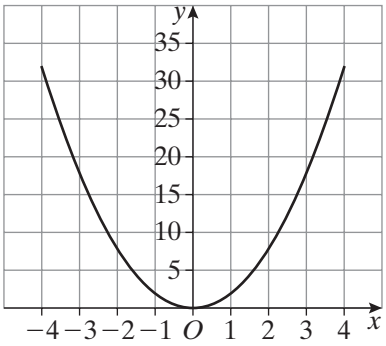
x	−4	−3	−2	−1	0	1	2	3
x^2	16	9	4	1	0	1	4	9
$2x$	−8	−6	−4	−2	0	2	4	6
-6	−6	−6	−6	−6	−6	−6	−6	−6
y	2	−3	−6	−7	−6	−3	2	9

b)

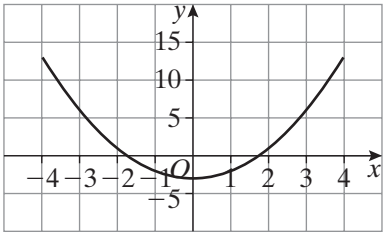


c) $x = 1.6$, $x = -3.6$

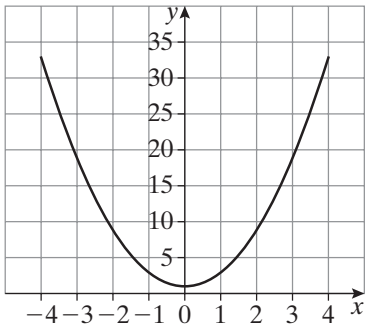
6 a)



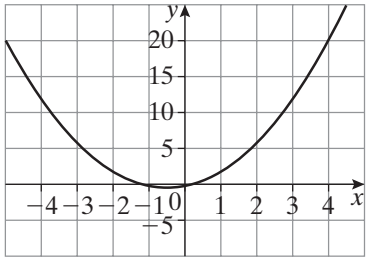
b)



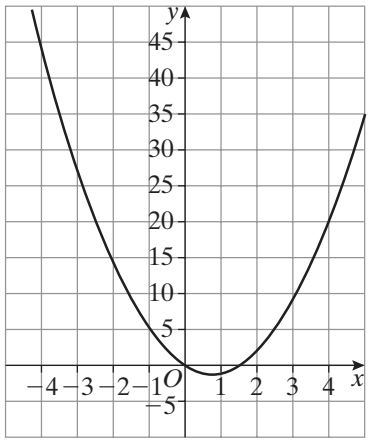
c)



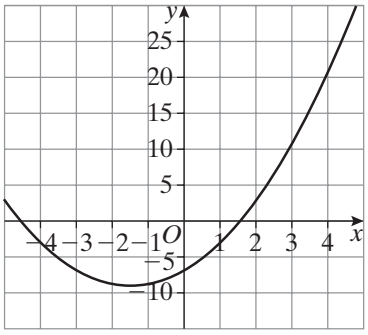
d)



e)



f)



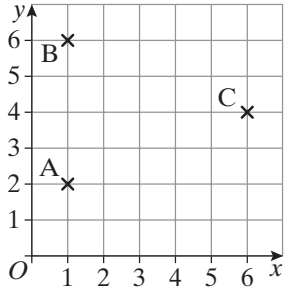
Review Exercise 10

1 a) A (6, 9), B (0, 7), C (5, 7), D (9, 3), E (5, 1), F(0, 4), G (2, 0), H (8, 0)

b) (i) (5, 0) **(ii)** $(0, 5\frac{1}{2})$

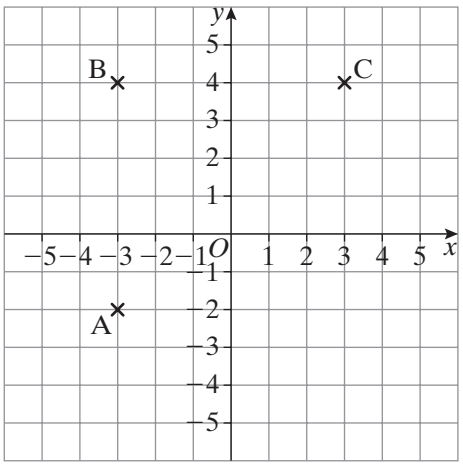
(iii) (5, 4) **(iv)** $(4\frac{1}{2}, 5)$

2 a)



b) D (6, 0) or (6, 8)

3 a)



b) D (3, −2)

c) (0, 1)

4 a) $x = -3$

b) $y = -x$

c) $x = 1$

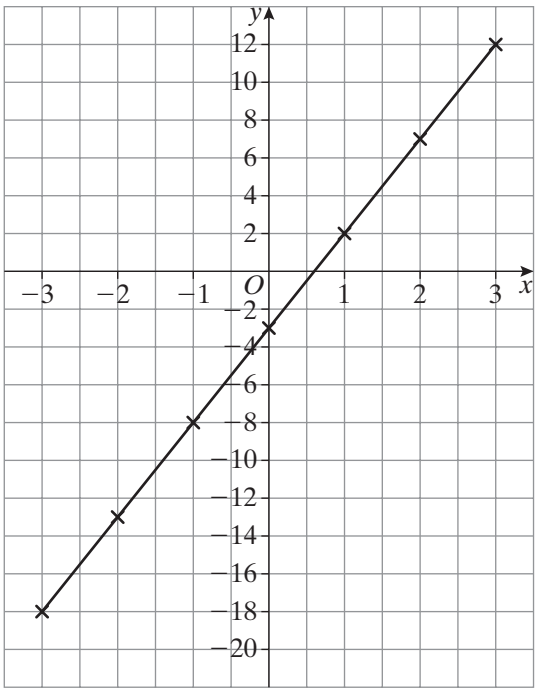
d) $y = -3$

5 A (0, 0, 0), B (5, 0, 0), C (0, 0, 4), D (5, 0, 4), E (0, 3, 0), F (5, 3, 0), G (0, 3, 4), H (5, 3, 4)

6 a)

x	−3	−2	−1	0	1	2	3
y	−18	−13	−8	−3	2	7	12

b)



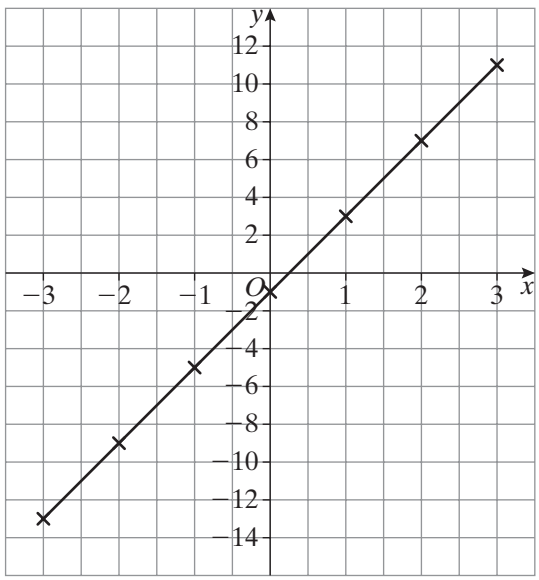
c) **(i)** $y = -14.5$ **(ii)** $x = 2.4$

d) 5

7 a)

x	−3	−2	−1	0	1	2	3
y	−13	−9	−5	−1	3	7	11

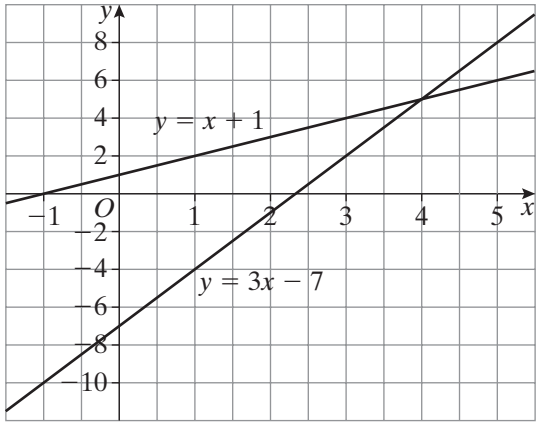
b)



c) **(i)** $y = 5.8$ **(ii)** $x = -2.5$

d) 4

8 a)



b) $x = 4$, $y = 5$

9 a) **(i)** A (5, 4) **(ii)** B (1, 0)

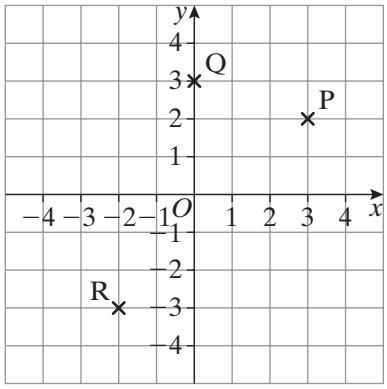
b) (3, 2) **(c)** 1

10 a) **(i)** A (0, 2) **(ii)** B (4, 1)

b) (2, 1.5)

11 a) P (3, 2)

b) **(i), (ii)**

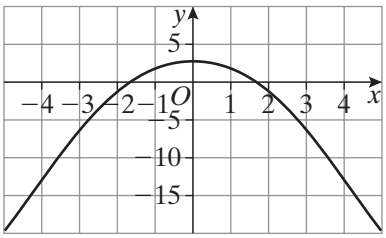


c) (−1, 0)

12 a)

x	−4	−3	−2	−1	0	1	2	3	4
3	3	3	3	3	3	3	3	3	3
$-x^2$	−16	−9	−4	−1	0	−1	−4	−9	−16
y	−13	−6	−1	2	3	2	−1	−6	−13

b)

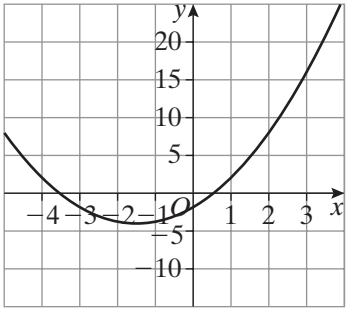


c) $x = \pm 1.7$

13 a)

x	−4	−3	−2	−1	0	1	2	3
x^2	16	9	4	1	0	1	4	9
$+3x$	−12	−9	−6	−3	0	3	6	9
-2	−2	−2	−2	−2	−2	−2	−2	−2
y	2	−2	−4	−4	−2	2	8	16

b)

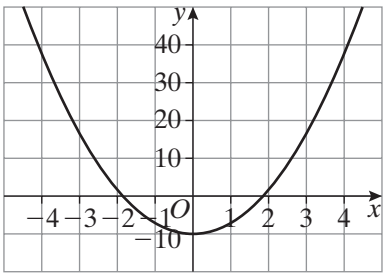


c) $x = 0.6$ or $x = -3.6$

14 a)

x	−4	−3	−2	−1	0	1	2	3	4
x^2	16	9	4	1	0	1	4	9	16
$3x^2$	48	27	12	3	0	3	12	27	48
-10	−10	−10	−10	−10	−10	−10	−10	−10	−10
y	38	17	2	−7	−10	−7	2	27	38

b)

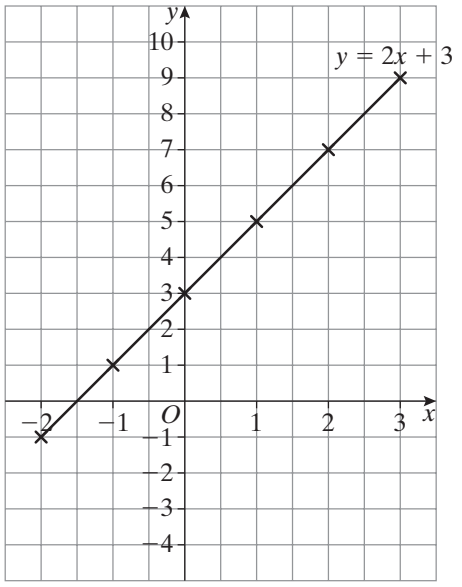


c) $x = \pm 1.8$

15 a)

x	−2	−1	0	1	2	3
y	−1	1	3	5	7	9

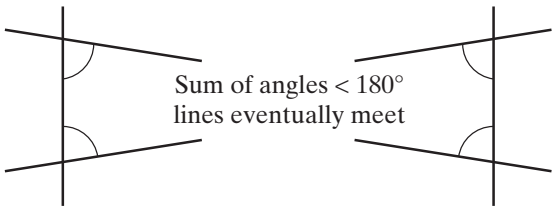
b)



c) (i) $y = 0.4$ **(ii)** $x = 1.2$

Internet Challenge 10

1 Parallelogram
2 Trapezium
3 A prism whose faces are all parallelograms.
4 Blondie
5 Border between USA and Canada
6 When any decision arises, all the possible outcomes occur, each in a separate 'parallel universe' hidden from the others.
7



8 On a (rather old) computer.
9 On a ski slope.
10 True
11 Yes (consider railway tracks going round a bend.
12 An electrician
13 a) All of them.
b) Bristol, Dr Richard Gregory

Chapter 11: Measurements

Starter 11

1 a) 3.4 kg **b)** 7.6 kg **c)** 0.35 kg
2 a) 11.5 cm **b)** 1.67 m **c)** 0.6 cm
3 a) 250 ml **b)** 375 ml **c)** 780 ml
4 a) 3.30 **b)** 9.15 **c)** 4.20
d) 7 o'clock **e)** 1.50 **f)** 10.50

Worksheet 11.S1

104 mm	9.3 cm	3.1 cm	18 mm	111 mm	5.4 cm	97 mm	4.1 cm	14 mm
53 mm	5.8 cm	83 mm	8.3 cm	61 mm	2.2 cm	11.7 cm	31 mm	2.5 cm
25 mm	7.2 cm	47 mm	12.7 cm	54 mm	123 mm	6.5 cm	10.4 cm	36 mm
1.4 cm	41 mm	6.1 cm	3.6 cm	58 mm	10 cm	22 mm	72 mm	5.3 cm
12.3 cm	65 mm	117 mm	11.1 cm	93 mm	4.7 cm	127 mm	1.8 cm	9.7 mm

Worksheet 11.S2

1 **a)** Audi 72 mph; BMW 77 mph; Chrysler 75 mph
b) BMW

2

Name	Weight of fish (g)	Position in competition
Derek	700	1st
Edwin	400	4th
Fabian	450	3rd
Gary	650	2nd

3

Room	Temp. (°C)	Temp. (°F)
Humanities	28	82
Technology	25	77
Maths	16	61
English	21	70

Exercise 11.1

1 **a)** 08 00 **b)** 21 20
c) 19 45 **d)** 11 05
e) 22 40 **f)** 06 25

2 **a)** 6.36 pm **b)** 10.43 pm
c) 12.13 am **d)** 11.10 am
e) 1.56 pm **f)** 2.27 am

3 12.12 pm

4 1 hour 44 minutes

5 **a)** 240 min **b)** 30 min
c) 20 min **d)** 15 min
e) 216 min **f)** 252 min

6 **a)** 2 hours **b)** 5 hours
c) 2.5 hours **d)** $\frac{3}{4}$ of an hour
e) $\frac{1}{4}$ of an hour **f)** $1\frac{1}{4}$ hours

7 **a)** 22 41 **b)** 23 26 **c)** 00 11

8 **a)** 15 37
b) **(i)** 27 minutes **(ii)** 16 minutes

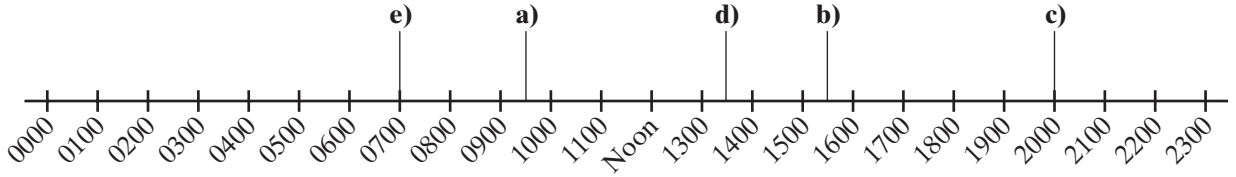
9 **a)** 57 minutes **b)** 18 28

Worksheet 11.1

1

	12-hour clock	24-hour clock
Heidi	10 pm	22 00
Iqbal	9.45 pm	21 45
Jarad	10.45 pm	22 45
Kaleb	8.30 pm	20 30
Lea	11.55 pm	23 55

2



a) 0930 **b)** 1530 **c)** 2000
d) 1330 **e)** 0700

3 **a)** 10 minutes **b)** Neighbours
c) The Paul O'Grady show; News Tonight
d) 19 15

4 a) and g); b) and h); c) and e); d) and j); f) and i)

5 Teacher to mark a), b) and c).

6 **a)** 1100 minutes; 18 hours 20 minutes
b) Calais and Nice
c) Total 400 minutes; 6 hours 40 minutes

Exercise 11.2

1 **a)** metres **b)** metres **c)** millilitres
d) grams **e)** kilometres **f)** centilitres
g) centimetres **h)** millimetres **i)** litres
j) tonnes **k)** metres **l)** kilograms

2 **a)** 1.23 m **b)** 3000 m **c)** 0.08 m
d) 500 m **e)** 0.01 m **f)** 3700 m
g) 1.234 m **h)** 10 000 m **i)** 0.57 m

3 **a)** 1.2 cm **b)** 400 cm **c)** 50 cm
d) 0.6 cm **e)** 5.7 cm **f)** 280 cm
g) 367 cm **h)** 2.8 cm **i)** 13.8 cm

4 **a)** 1200 g **b)** 0.45 tonnes **c)** 0.5 kg
d) 3240 g **e)** 3500 kg **f)** 400 g

5 **a)** 2000 ml **b)** 0.7 l **c)** 420 cl
d) 600 ml **e)** 0.45 l **f)** 30 cl

6 **a)** 200 mm **b)** 4 km **c)** 2000 mm
d) 1.25 km **e)** 4 mm **f)** 0.6 km

7 Answers will vary. They should be similar to:
a) ~1.8 m **b)** ~70 kg **c)** ~6 m × 7 m
d) ~2 m **e)** ~15 cm **f)** ~500 g
g) ~250 ml **h)** ~100 g

8 **a)** 30 000 cm^2 **b)** 4 cm^2
c) 2 000 000 cm^3 **d)** 2500 mm^3
e) 0.5 cm^3 **f)** 30 000cm^3
g) 750 mm^2 **h)** 3200 mm^2
i) 15 cm^3 **j)** 250 000 cm^3
k) 3 cm^2 **l)** 4 200 000 cm^3
m) 3500 mm^3 **n)** 0.2 m^2

Worksheet 11.2

1 **a)** thermometer, °C **b)** stopwatch, seconds
c) kitchen scales, g **d)** tape measure, cm
e) measuring jug, ml **f)** ruler, cm/mm
g) bathroom scales, kg

2 **a)** 70 + 65
b) 70 + 20 + 45 or
70 + 30 + 35 or
70 + 25 + 40 or
65 + 25 + 45 or
65 + 30 + 40
c) see **b)**
d) 150 cm or 1.5 m

3

1 5	0	■	2 2	3 5
0	■	4 3	0	0
0	■	5 5	0	0
■	6 9	0	0	0
7 2	■	■	8 8	■
9 7	0	0	0	■

4 **a)** 7000 kg **b)** 570 mm **c)** 544 000 g
d) 277 cm **e)** 230 000 ml

Exercise 11.3

1 **a)** feet/yards **b)** feet/yards **c)** ounces
d) miles **e)** inches **f)** pints
g) pounds

2 **a)** 80 km **b)** 48 km **c)** 10 miles
d) 40 km **e)** 100 miles **f)** 15 miles

3 **a)** 90 litres **b)** 50 kg **c)** 2 gallons
d) 3 feet **e)** 17.5 pints **f)** 4 inches

4 **a)** 30 kg **b)** 28.8 km **c)** 54 litres
d) 33 lb **e)** 50 cm **f)** 8.6 l

5 **a)** 1.65 m **b)** 64 kg

6 45 l **7** 352 km

Worksheet 11.3

1 **a)** kg **b)** foot **c)** l **d)** ounce

2

						[1]C						
[2]M	I	L	L	I	M	E	T	R	E			
						N		[3]C			[4]P	
[5]K	I	L	O	M	E	T	R	E			O	
I						I		N			U	
[6]L	I	T	R	E		M		[7]T	O	N	N	E
O						E		I			D	
[8]G	R	A	M			T		L				
R		[9]Y				R		[10]I	N	C	H	[11]F
A		A				E		T				E
[12]M	E	T	R	E				R				E
		D	[13]O	U	N	C	E					T

3 **a)** 19.8 m **b)** 5 kg **c)** 16.2 m
d) 300 cm **e)** 1080 cm **f)** 41.6 km

Exercise 11.4

1 350 miles **2** 150 km **3** 3 km
4 18 km **5** 50 mph **6** 15 mph
7 5 hours **8** 120 m **9** 40 minutes

10 **a)** 4 m/s **b)** 14.4 km/h

11 **a)** **(i)** 30 km **(ii)** 20 km **(iii)** 90 km
b) **(i)** 30 minutes **(ii)** 6 minutes
(iii) 100 minutes
c) 33.3 m/s

Worksheet 11.4/5

1 $\frac{180}{3} = 60$ mph **2** $\frac{20}{0.5} = 40$ km/h

3 **a)** 8 m/s **b)** 10.2 m/s

4 $300 \times 2 = 600$ miles

5 Angelina: $1\frac{1}{2}$ hours (Brad 2 hours)

6 density of water: 1000 kg/m^3
mass of silver: 105 g
volume of gold: 100 cm^3

Exercise 11.5

1 **a)** **(i)** 5000 kg **(ii)** 20000 kg
(iii) 500 kg **(iv)** 750 kg
b) **(i)** 0.2 m^3 **(ii)** 6 m^3
(iii) 0.85 m^3 **(iv)** 1.5 m^3

2 **a)** 2.38 cm^3 **b)** 11.9 cm^3 **c)** 26.2 g

3 **a)** 0.27 g/cm^3 **b)** 0.27 g **c)** 270 000 g
d) 270 kg **e)** 270 kg/m^3

Exercise 11.6

1 **a)** **(i)** 25.5 **(ii)** 26.5
b) **(i)** 792.5 **(ii)** 793.5
c) **(i)** 79.5 **(ii)** 80.5
d) **(i)** 4.5 **(ii)** 5.5
e) **(i)** 489.5 **(ii)** 490.5

2 **a)** **(i)** 127.5g **(ii)** 128.5g
b) **(i)** 62.5 kg **(ii)** 63.5 kg
c) **(ii)** 119.5 cm **(ii)** 120.5 cm
d) **(i)** 7.5 cm **(ii)** 8.5 cm
e) **(i)** 22.5 km **(ii)** 23.5 km
f) **(i)** 3.5 m **(ii)** 4.5 m

Worksheet 11.6

1 **a)** 19: 18.9, 18.5, 19.1
b) 4: 4.1, 3.5, 3.9 **c)** 48: 47.6, 48.2, 47.5

2 **a)** 6 **b)** 8 **c)** 19 **d)** 52
e) 2 **f)** 20 **g)** 60

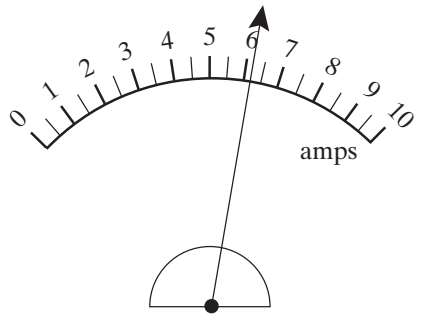
3 biggest (upper bound): 9.4; smallest (lower bound): 8.5

Review Exercise 11

1 **a)** **(i)** centimetres **(ii)** grams
b) **(i)** miles **(ii)** pounds

2 **a)** The volume of coffee in a mug is 310 millilitres. The height of a door is 215 centimetres. The weight of a one pound coin is 12 grams.
b) 8000 m

3 **a)** 4.5 amps **b)** 3.8 amps to 3.9 amps
c)



d) **(i)** 50 °F **(ii)** −10 °C

4 **a)** 400 km/h **b)** 6 km **c)** 5 minutes

5 **a)** 100 000 cm^2 **b)** 45 000 cm^2
c) 0.33 cm^3 **d)** 2000 mm^3

6 **a)** 3560 kg **b)** 0.25 m^3

7 **a)** 11 23 **b)** 11 25
c) 43 minutes **d)** 24 minutes

8 **a)** ~1.8 m **b)** ~4.5 m

9 **a)** 09 30 **b)** 2 hours 45 minutes
c) 17 minutes

10 **a)** **(i)** millilitres **(ii)** kilograms
(iii) millimetres **(iv)** grams
b) 22 lb **c)** 4 litres

11 Yes. 80 m/s = 80 × 60 × 60/1000 km/h = 288 km/h

Internet Challenge 11

The tea clipper Cutty Sark	20 mph
Challenger 2 tank	37 mph
Disney's Space Mountain roller coaster (Paris)	43 mph
Intercity 225 train	140 mph
Porsche 911 GT3 RS car	190 mph
Boeing 747-400 passenger jet aircraft	630 mph
Speed of sound (in air)	760 mph
Eurofighter Typhoon jet aircraft	1320 mph
Orbiting Space Shuttle	17 600 mph
Apollo 11 spacecraft	24 500 mph

Chapter 12: Interpreting graphs

Starter 12

A1, B4, C5, D6, E7, F2, G8, H3

Exercise 12.1

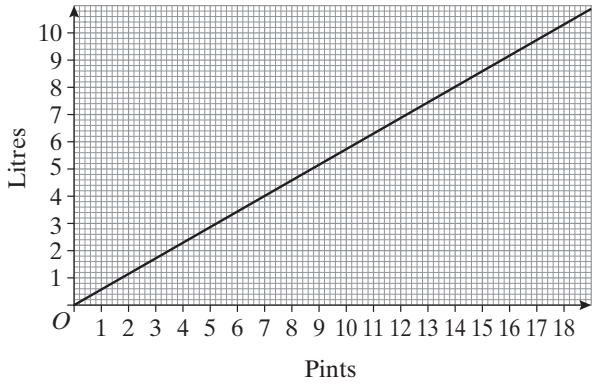
1 **a)** 70 kg **b)** 57 kg **c)** 6.4 kg
d) 7.9 stones **e)** 2.4 stones **f)** 4 stones

2 **a)** 32 oz **b)** 120 oz
c) **(i)** 3.5 lb **(ii)** 2.2 lb

3 **a)** 104 °F **b)** 38 °C
c) 14 °F **d)** −40 °C and −40 °F

4 **a)** 100 °C
b) **(i)** 33 °C **(ii)** 20 °C
c) 1 minute

5 **a)**

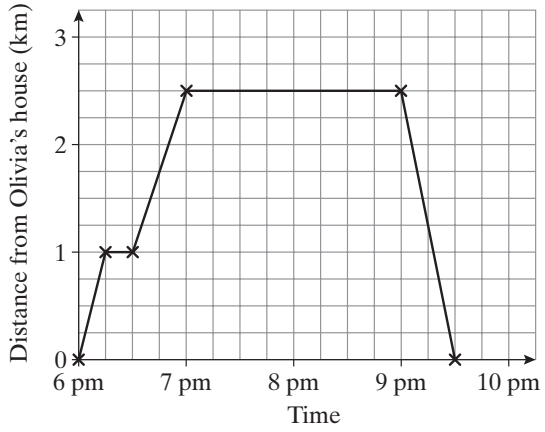


b) **(i)** 1.1 litres **(ii)** 5.7 litres
c) **(i)** 14 pints **(ii)** 5.3 pints

6 A: Water flows out of cylinder at a steady rate.

Exercise 12.2

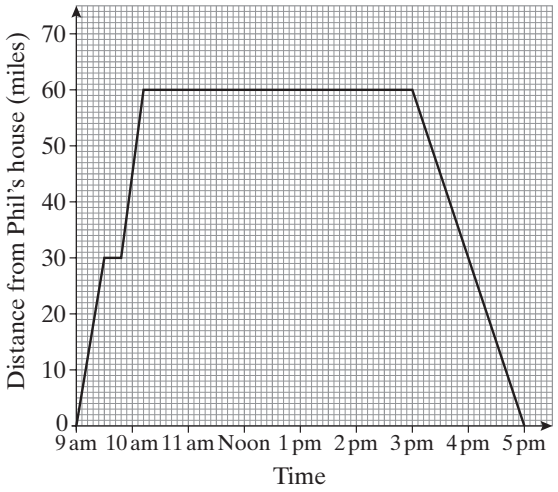
1 **a)**



b) 5 km/h

2 **a)** 10.12 am **b)** 18 minutes

c)



d) 30 mph

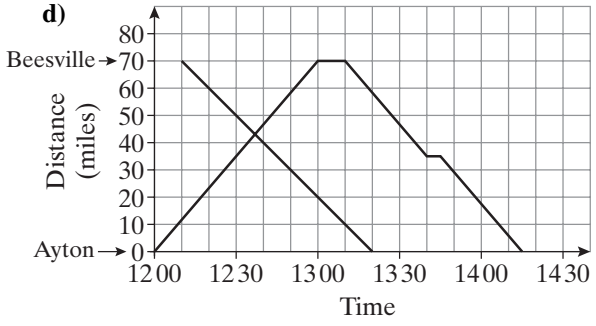
3 **a)** 15 minutes **b)** 16 30 **c)** 8 km
d) C and D as the line is steeper
e) 17 45

4 **a)** 8.15 am **b)** 20 minutes
c) **(i)** 0.8 km **(ii)** 3.8 km
d) **(i)** 3.2 km/h **(ii)** 18 km/h

5 **a)** 4.2 km **b)** 10 00
c) 10 42 **d)** 2.7 km
e) 1 hour 24 minutes **f)** 13 18

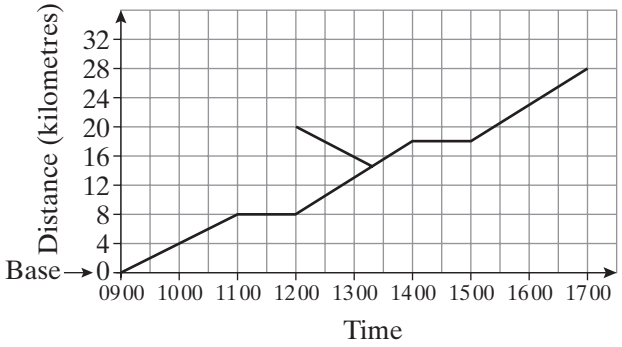
6 **a)** 20 minutes **b)** 12 km/h **c)** No

7 **a)** 70 km/h
b) the train stops
c) speed of the train
d)



e) 12 37

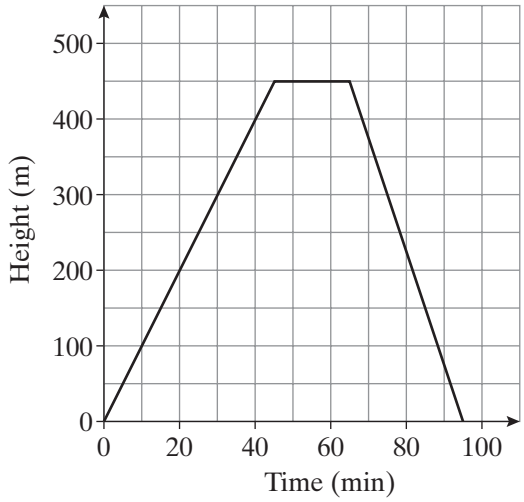
8 **a), b)**



c) 13 20

9 **a)** 450 m
b) 30 minutes

c)



Review Exercise 12

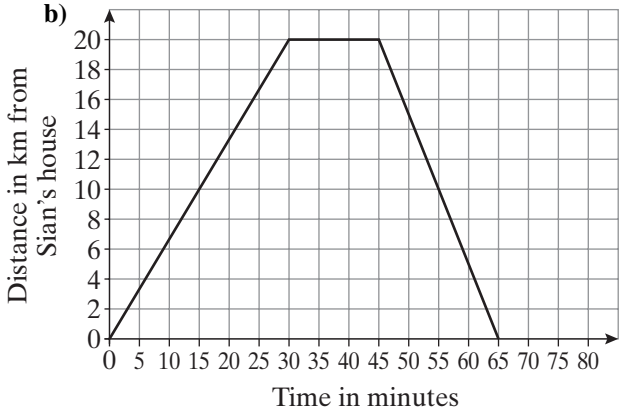
1 B

2 AQ; BR; CS; DP

3 **a)** 09 05 **b)** 7 km
c) 10 minutes **d)** 21 km/h

4 **a)** 40 km/h

b)



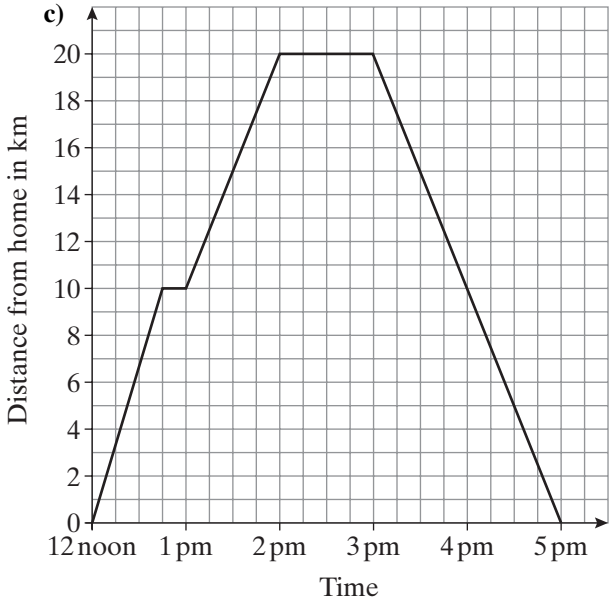
5 AR; BS; CQ; DP

6 **a)** £90.72 **b)** 132 units
c) **(i)** £60 **(ii)** 150 units

7 **a)** 10 kg **b)** 5.5 lb **c)** 50 kg

8 **a)** 15 minutes **b)** 15 km

c)



9 **a)** 13 06 **b)** 10 00 and 11 00 **c)** 50 km/h

10 **a)** 6 m/s **b)** 10.7 m/s **c)** 15 m

Internet Challenge 12

1 Circle **2** Parabola **3** Catenary
4 Spiral **5** Ellipse **6** Fractal
7 Cardioid **8** Cycloid

Chapter 13: Angles

Starter 13

1 answers will vary

2 **a)** 70° **b)** 120° **c)** 25° **d)** 270°
e) 40° **f)** 330° **g)** 250°

Worksheet 13S

1 68°	**2** 50°	**3** 169°	**4** 90°
5 123°	**6** 75°	**7** 112°	**8** 11°
9 163°	**10** 90°	**11** 33°	**12** 46°
13 22°	**14** 55°	**15** 17°	**16** 33°
17 33°	**18** 88°	**19** 101°	**20** 35°

Exercise 13.1

1 **a)** acute **b)** obtuse **c)** acute
d) reflex **e)** acute **f)** reflex
g) reflex

2 **a)** **(i)** $a = 125°$
(ii) angles along a straight line add up to 180°
b) **(i)** $b = 53°$
(ii) angles along a straight line add up to 180°
c) **(i)** $c = 53°$
(ii) angles around a point add up to 360°
d) **(i)** $d = 54°$
(ii) angles around a point add up to 360°
e) **(i)** $e = 68°$
(ii) angles in a triangle add up to 180°
f) **(i)** $f = 53°$
(ii) angles in a triangle add up to 180°
g) **(i)** $g = 45°$
(ii) triangle is a right angled isosceles
h) **(i)** $h = 55°$
(ii) angles in a triangle add up to 180°
i) **(i)** $i = 42°$
(ii) triangle is isosceles
j) **(i)** $j = 60°$
(ii) triangle is equilateral
k) **(i)** $x = 65°$, $k = 50°$
(ii) triangle is isosceles and angles in a triangle add up to 180°
l) **(i)** $l = 32°$
(ii) angles in a quadrilateral add up to 360°
m) **(i)** $m = 55°$
(ii) angles in a quadrilateral add up to 360°
n) **(i)** $n = 77°$, $y = 103°$
(ii) triangle is isosceles and angles add up to 180°; angles along a straight line add up to 180°
o) **(i)** $o = 120°$
(ii) triangle is equilateral so interior angle is 60°, and angles along a straight line add up to 180°
p) **(i)** $p = 80°$
(ii) angles along a straight line add up to 180° and angles in a triangle add up to 180°; triangle is isosceles, so other angles are both 50°

Worksheet 13.1

1 1	3	2 8		3 2	8
5		4 1	5 4	9	
6			6		6 7
	7 6	8 4		9 2	3
10 1	0	7		0	

Exercise 13.2

1 $a = 25°$
2 $x = 64°$
3 $m = 85°$
4 $y = 88°$
5 $z = 106°$
6 **a)** $2x + 62°$ **b)** $2x + 62° = 180°$
c) $x = 59°$ **d)** 71°, 56°, 53°
7 **a)** $8y + 4$ **b)** $8y + 4 = 180$
c) $y = 22°$ **d)** 32°, 66°, 82°
8 **a)** $3x + 90 = 180$
b) $x = 30°$
c) 38, 52°, 90°
9 **a)** $16c + 4 = 180$ **b)** $c = 11$
c) 48°, 48°, 84° **d)** isosceles
10 **a)** $10y + 50 = 360$
b) $y = 31°$
c) 98°, 103°, 82°, 77°
11 **a)** $3k + 183 = 360$
b) $k = 59°$
c) 90°, 65°, 90°, 115°
12 **a)** $11x + 8 = 360°$
b) $x = 32°$
c) 48°, 62°, 105°, 145°
d) $48° + 62° + 105° + 145° = 360°$

Exercise 13.3

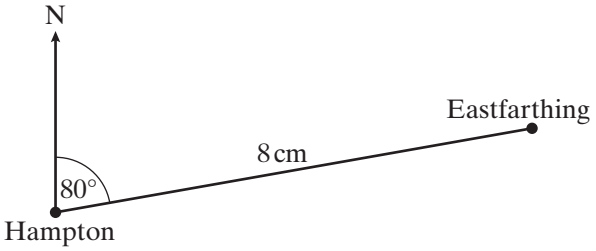
1 $a = 125°$, $b = 55°$
2 $c = 44°$, $d = 136°$, $e = 136°$
3 $e = 50°$, $f = 130°$, $g = 130°$, $h = 130°$
4 $i = 110°$, $j = 110°$, $k = 110°$
5 $a = 68°$, $b = 68°$, $c = 68°$
6 $d = 131°$, $e = 49°$
7 $f = 61°$, $g = 61°$, $h = 119°$
8 $i = 71°$, $j = 65°$, $k = 44°$
9 $m = 13°$, $n = 77°$, $l = 13°$
10 $o = 52°$, $p = 52°$, $q = 90°$
11 $r = 55°$
12 $s = 132°$, $t = 48°$
13 **a)** $3x - 50° = 2x - 20°$ **b)** $x = 30°$

Exercise 13.4

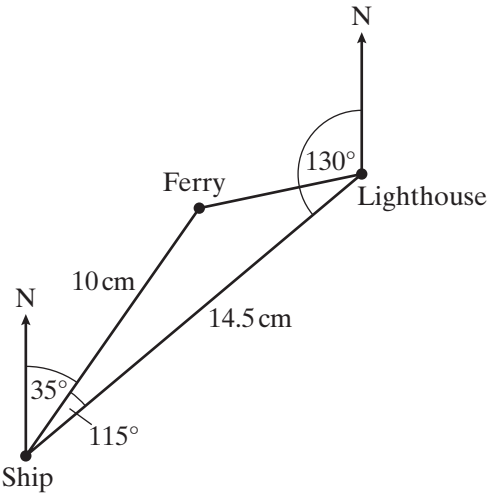
1 **a)** **(i)** 1080° **(ii)** 3240°
b) **(i)** 135° **(ii)** 162°
c) **(i)** No **(ii)** No
Neither 135 nor 162 is a factor of 360
2 **a)** **(i)** 60° **(ii)** 24°
b) **(i)** 120° **(ii)** 156°
c) **(i)** Yes, since 120 is a factor of 360
(ii) No, because 156 is not a factor of 360
3 142°
4 **a)** 24 sides
b) The exterior angle is 14°; 14 is not a factor of 360
5 120°
6 **a)** $5x + 290$ **b)** $5x + 290 = 540$
c) $x = 50°$ **d)** 90°, 90°, 130°, 120°, 110°
7 $a = 135°$
8 Drawing as instructed
9 Constructions based on instructions in Q8 for regular a) octagon, b) 9-sided polygon, c) 9-pointed star, inscribed in a circle

Exercise 13.5

1 Abbotsville 045°, Stoneybridge 090°, Middlehampton 115°, Little Chapel 220°, Appleton 312°
2 **a)** 090° **b)** 270°
c) 135° **d)** 315°
3 Diagram not accurately drawn



4 **a), b)** Diagram not accurately drawn

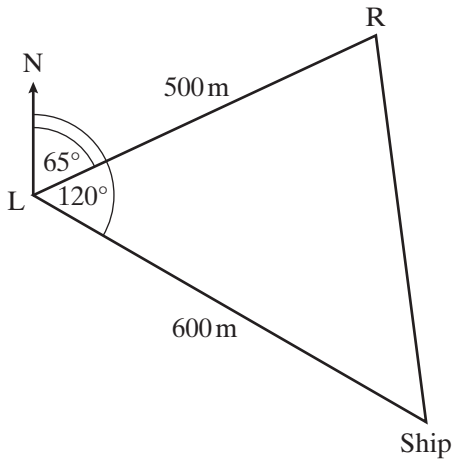


c) 258°
5 **a)** 067° **b)** 247°
6 **a)** 106° **b)** 286°
7 **a)** 225° **b)** 045°
8 327°
9 212°
10 **a)** 070°
b) **(i)** 250° **(ii)** 210° **(iii)** 030°
(iv) 310° **(v)** 130°

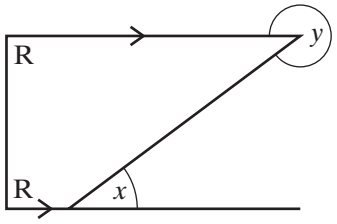
Review Exercise 13

1 $a = 40°$, $b = 140°$, $c = 40°$, $d = 55°$, $e = 60°$, $f = 36°$, $g = 65°$, $h = 30°$, $i = 60°$, $j = 60°$, $k = 120°$, $l = 120°$, $m = 36°$, $n = 18°$, $o = 54°$, $p = 63°$, $q = 58°$, $r = 45°$, $s = 66°$, $t = 15°$, $u = 45°$, $v = 30°$, $w = 140°$, $x = 58°$, $y = 14°$, $z = 166°$
2 a = 52°, b = 38°
3 298°

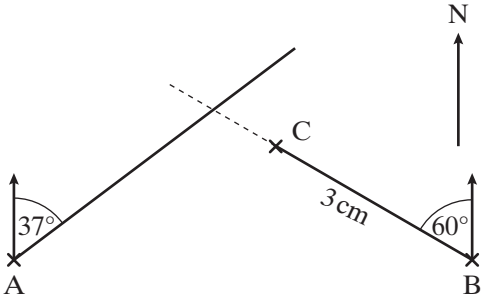
4 a) 245°
b), c)



d) 173°
5 a) $10y + 60°$ **b)** $y = 30°$ **c)** 110°, 70°, 110°, 70°
d) parallelogram
6 a) 30° **b)** 150° **c)** No
7 13 sides
8 90 sides
9 a) b)



c) (i) acute **(ii)** reflex
10 a) (i) 60° **(ii)** equilateral triangle
b) 150°
11 a) hexagon
b) angles round a point total 360°
So $2x + 90° = 360°$, so $2x = 270°$, so $x = 135°$
12 a) (i) 60° **(ii)** all angles are equal
b) (i) 130°
(ii) triangle is isosceles, so ∠SQR = 50°; angles on a straight line total 180°, so $x = 130°$
c) 64°
13 a) 7 pm
b) (i) 103° **(ii)** 248°
14 a), b)



15 a) acute **b)** reflex
c) angles should total 360° not 350°
16 a) scalene **b)** 64° **c)** acute
17 a) 54°
b) 72° ∠PQR = 54° as triangle is isosceles; angles in a Δ add up to 180°
18 a) (i) 109° **(ii)** angles on a straight line total 180°
b) (i) 24° **(ii)** alternate angles are equal
19 a) 42° **b)** 69°
20 30°
21 a) 60° **b)** 120° **c)** 12 cm²
22 140°
23 a) 31° **b)** 135° **24 a)** 60° **b)** 120°
25 142°

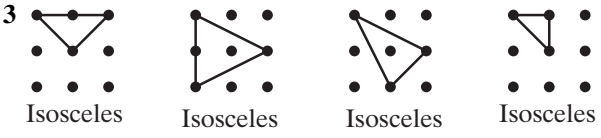
Internet Challenge 13

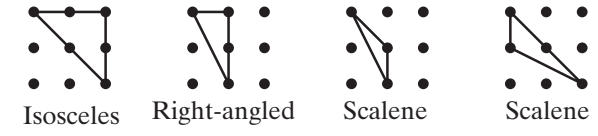
1 Francis Guthrie
2 Alfred Kempe
3 Peter Tait
4 1976
5 Kenneth Appel and Wolfgang Haken
6 It was computer-assisted.
7 Four colours (as before)
8 Seven colours
9 Gardner claimed to have found a map that required five colours.
10 A real map-maker might want to colour two separate regions (for example, Alaska and USA) in the same colour to indicate political association. This adds extra restrictions and thus might require extra colours.

Chapter 14: 2-D and 3-D shapes

Starter 14

1 A: perimeter = 8 cm, area = 4 cm²
B: perimeter = 20 cm, area = 24 cm²
C: perimeter = 12 cm, area = 8 cm²
D: perimeter = 16 cm, area = 11 cm²
E: perimeter = 12 cm, area = 6 cm²
2 A area = 8 cm², B area = 4.5 cm², C area = 12 cm²
3





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