Value after 1 year = $\frac{100 + 6.25}{100} \times \pounds 3600$ = $\frac{106.25}{100} \times \pounds 3600$ = $1.0625 \times \pounds 3600$ = $\pounds 3825$

Problem 23. The price of a fully installed combination condensing boiler is increased by 6.5%. It originally cost £2400. What is the new price?

New price =
$$\frac{100 + 6.5}{100} \times \pounds 2,400$$

= $\frac{106.5}{100} \times \pounds 2,400 = 1.065 \times \pounds 2,400$
= $\pounds 2,556$

Now try the following Practice Exercise

Practice Exercise 23 Further percentages (answers on page 342)

- 1. A machine part has a length of 66 nm. The length is incurrently reasured as 36.9 mm. Determine has been tage error in the new outputst.
- 2. When a resistor is removed from an electrical circuit the current flowing increases from $450 \,\mu\text{A}$ to $531 \,\mu\text{A}$. Determine the percentage increase in the current.
- 3. In a shoe shop sale, everything is advertised as '40% off'. If a lady pays £186 for a pair of Jimmy Choo shoes, what was their original price?
- 4. Over a four year period a family home increases in value by 22.5% to £214375. What was the value of the house 4 years ago?
- 5. An electrical retailer makes a 35% profit on all its products. What price does the retailer pay for a dishwasher which is sold for £351?
- 6. The cost of a sports car is £23500 inclusive of VAT at 17.5%. What is the cost of the car without the VAT added?
- £8000 is invested in bonds at a building society which is offering a rate of 6.75% per

annum. Calculate the value of the investment after 2 years.

- An electrical contractor earning £36000 per annum receives a pay rise of 2.5%. He pays 22% of his income as tax and 11% on National Insurance contributions. Calculate the increase he will actually receive per month.
- 9. Five mates enjoy a meal out. With drinks, the total bill comes to £176. They add a 12.5% tip and divide the amount equally between them. How much does each pay?
- 10. In December a shop raises the cost of a 40 inch LCD TV costing £920 by 5%. It does not sell and in its January sale it reduces the TV by 5%. What is the sale price of the TV?
- 11. A man buye a listice and makes a 20% profit the results it three years later for experimental profit of the business?
 - A bridling machine should be set to 250 rev/min. The nearest speed available on the machine is 268 rev/min. Calculate the percentage overspeed.
 - 13. Two kilograms of a compound contain 30% of element A, 45% of element B and 25% of element C. Determine the masses of the three elements present.
 - 14. A concrete mixture contains seven parts by volume of ballast, four parts by volume of sand and two parts by volume of cement. Determine the percentage of each of these three constituents correct to the nearest 1% and the mass of cement in a two tonne dry mix, correct to 1 significant figure.
 - 15. In a sample of iron ore, 18% is iron. How much ore is needed to produce 3600kg of iron?
 - 16. A screw's dimension is $12.5 \pm 8\%$ mm. Calculate the maximum and minimum possible length of the screw.
 - 17. The output power of an engine is 450 kW. If the efficiency of the engine is 75%, determine the power input.

(v) **Circle** Area = πr^2 Circumference = $2\pi r$



Radian measure: 2π radians = 360 degrees

For a sector of circle:

arc length, $s = \frac{\theta^{\circ}}{360}(2\pi r) = r\theta$ $(\theta \text{ in rad})$

shaded area = $\frac{\theta^{\circ}}{360}(\pi r^2) = \frac{1}{2}r^2\theta$ $(\theta \text{ in rad})$

> $Volume = l \times b \times h$ Surface area = 2(bh + hl + lb)

> > Volume = $\pi r^2 h$

h

Equation of a circle, centre at origin, radius *r*:

$$x^2 + y^2 = r^2$$

h

(ii) Cylinder

solids:

Equation of a circle, centre at (a, b), radius r:

 $(x-a)^2 + (y-b)^2 = r^2$

(i) Rectangular prism (or cuboid)

b

(iii) Pyramid

If area of base = A and perpendicular height = h then: Volume = $\frac{1}{3} \times A \times h$ Total surface area = sum of areas of triangles forming sides + area of base (iv) Cone Note Surved Surface area = πrl Pal Surface area $= \pi r l + \pi r^2$ ge 9 of 3 Volumes and surface of regular (v) Sphere Volume = $\frac{4}{3}\pi r^3$ Surface area = $4\pi r^2$ Total surface area = $2\pi rh + 2\pi r^2$

5. x = 2, y = 4, z = 5 **6.** x = 1, y = 6, z = 77. x = 5, y = 4, z = 2 8. x = -4, y = 3, z = 29. x = 1.5, y = 2.5, z = 4.5**10.** $i_1 = -5, i_2 = -4, i_3 = 2$ **11.** $F_1 = 2, F_2 = -3, F_3 = 4$

2. 4 or −8

8. −5

3. 2 or −6

6. 2 or −2

9. 1

Chapter 14

1. 4 or −4

7.4

Exercise 54 (page 104)

4. -1.5 or 1.5 5. 0 or $-\frac{4}{3}$

Exercise 57 (page 109)

- **1.** 1.191s **2.** 0.345 A or 0.905 A **3.** 7.84 cm
- **4.** 0.619 m or 19.38 m **5.** 0.0133

7. 86.78 cm

9. 7 m

- **6.** 1.066 m
- **8.** 1.835 m or 18.165 m
- **10.** 12 ohms, 28 ohms

Exercise 58 (page 110)

1.
$$x = 1, y = 3$$
 and $x = -3, y = 7$
2. $x = \frac{2}{5}, y = -\frac{1}{5}$ and $-1\frac{2}{3}, y = -4\frac{1}{3}$



Exercise 55 (page 106)

1. −3.732 or −0.268	2. -3.137 or 0.637
3. 1.468 or −1.135	4. 1.290 or 0.310
5. 2.443 or 0.307	6. −2.851 or 0.351

Exercise 56 (page 107)

1.	0.637 or −3.137	2.	0.296 or -0.792
3.	2.781 or 0.719	4.	0.443 or −1.693
5.	3.608 or −1.108	6.	1.434 or 0.232
7.	0.851 or -2.351	8.	2.086 or -0.086
9.	1.481 or -1.081	10.	4.176 or −1.676
11.	4 or 2.167	12.	7.141 or -3.641
13.	4.562 or 0.438		

Exercise 60 (page 115)

1.	log6	2.	log15	3.	log2	4.	log3
5.	$\log 12$	6.	log 500	7.	log 100	8.	log6
9.	$\log 10$	10.	$\log 1 = 0$	11.	log2		
12.	log 243	3 or 1	og 3 ⁵ or 51	og3			
13.	$\log 16 \text{ or } \log 2^4 \text{ or } 4 \log 2$						
14.	log64	or lo	g2 ⁶ or 610	g2			
15.	0.5	16.	1.5	17.	x = 2.5	18.	t = 8
19.	b = 2	20.	x = 2	21.	a = 6	22.	x = 5

Exercise 61 (page 116)

1. 1.690 **2.** 3.170 **3.** 0.2696 **4.** 6.058 **5.** 2.251 **6.** 3.959 **7.** 2.542 **8.** -0.3272 **9.** 316.2

Chapter 25

Exercise 96 (page 221)

1. $p = 105^{\circ}, q = 35^{\circ}$ **2.** $r = 142^{\circ}, s = 95^{\circ}$ **3.** $t = 146^{\circ}$

Exercise 97 (page 225)

1. (i) rhombus (a) 14 cm² (b) 16 cm (ii) parallelogram (a) 180 mm^2 (b) 80 mm (iii) rectangle (a) 3600 mm^2 (b) 300 mm (iv) trapezium (a) 190 cm^2 (b) 62.91 cm^2

2. $35.7 \mathrm{cm}^2$	3. (a) 80 m (b) 170 m	4. $27.2 \mathrm{cm}^2$
5. 18 cm	6. 1200 mm	
7. (a) 29cm^2	(b) $650 \mathrm{mm^2}$	8. 560 m ²
9. 3.4 cm	10. 6750 mm ²	11. 43.30 cm ²
12. 32		

Exercise 98 (page 226)

1. 482 m^2 **2.** (a) 50.27 cm^2 (b) 706.9 mm^2 (c) 3183 mm^2 From N 2200-21 **3.** 2513 mm^2 **4.** (a) 20.19 mm (b) 63.41 mm**5.** (a) 53.01 cm^2 (b) 129.9 mm^2 **7.** 1.89 m² Exerci

1. 1932 mm² **2.** 1624 mm² **3.** (a) 0.918 ha (b) 456 m

Exercise 100 (page 229)

2. $80 \,\mathrm{m}^2$ **3.** 3.14 ha **1.** 80 ha

Chapter 26

Exercise 101 (page 231)

1. 45.24 cm 2. 259.5 mm 3. 2.629 cm 4. 47.68 cm 5. 38.73 cm 6. 12730 km 7. 97.13 mm

Exercise 102 (page 232)

1. (a) $\frac{\pi}{6}$ (b) $\frac{5\pi}{12}$ (c) $\frac{5\pi}{4}$ **2.** (a) 0.838 (b) 1.481 (c) 4.054 **3.** (a) 210° (b) 80° (c) 105° **4.** (a) $0^{\circ}43'$ (b) $154^{\circ}8'$ (c) $414^{\circ}53'$

Exercise 103 (page 234)

1. $113 \mathrm{cm}^2$	2. 2376 mm ²	3. 1790 mm ²
4. 802 mm ²	5. 1709 mm ²	6. 1269 m ²
7. 1548 m ²	8. (a) 106.0 cm (b)	783.9cm^2
9. 21.46 m ²	10. 17.80 cm, 74.07	cm ²
11. (a) 59.86 r	nm (b) 197.8 mm	12. 26.2 cm
13. 8.67 cm, 5	4.48 cm 14. 82.5°	15. 748
16. (a) 0.698 r	rad (b) $804.2 \mathrm{m}^2$	17. 10.47 m ²
18. (a) 396 mr	n ² (b) 42.24%	19. 701.8 mm
20. 7.74 mm		

Exercise 104 (page 237)

- **1.** (a) 2 (b) (3, -4)**2.** Centre at (3, -2), radius 4
- **3.** Circle, centre (0, 1), radius 5
- 4. Circle, centre (0, 0), radius 6

C	hapter 27				JK	
Exe	ercise 105 (p. c	2437			
Ø	(a) $3840 \mathrm{mm}$	2.	5 cm ³ 1792 mm	3.	8 cm ³	
5.	972 tres	6 9.	$15 \mathrm{cm}^3, 1$ (a) 35.3	35 g cm ³ (b)	7. 5	00 litres
12	(a) 2400 cm^3	³ (b)	$2460 \mathrm{cm}^2$	11.	37.04 m	
12. 14.	4.709 cm, 1	53.90	cm^2	3 1 00	0?	
15. 17.	2.99 cm 8.22 m by 8	10. .22 m	28000 cm	18. 62	.5 min	
19.	4 cm	20.	4.08 m ³			

Exercise 106 (page 246)

- **1.** 201.1 cm³, 159.0 cm² **2.** 7.68 cm³, 25.81 cm² **3.** 113.1 cm³, 113.1 cm² **4.** 5.131 cm **5.** 3 cm
- **6.** 2681 mm^3 **7.** (a) 268083 mm^3 or 268.083 cm^3 (b) $20106 \,\mathrm{mm^2}$ or $201.06 \,\mathrm{cm^2}$

8.8.53 cm

9. (a) $512 \times 10^6 \text{ km}^2$ (b) $1.09 \times 10^{12} \text{ km}^3$ **10.** 664

Exercise 107 (page 251)

- 1. $5890 \,\mathrm{mm^2}$ or $58.90 \,\mathrm{cm^2}$
- **2.** (a) 56.55 cm^3 (b) 84.82 cm^2 3. 13.57kg
- **4.** $29.32 \,\mathrm{cm}^3$ **5.** 393.4 m²
- **6.** (i) (a) 670 cm^3 (b) 523 cm^2 (ii) (a) 180 cm^3 (b) 154 cm^2 (iii) (a) 56.5 cm^3 (b) 84.8 cm^2 (iv) (a) 10.4 cm^3 (b) 32.0 cm^2 (v) (a) 96.0 cm^3

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