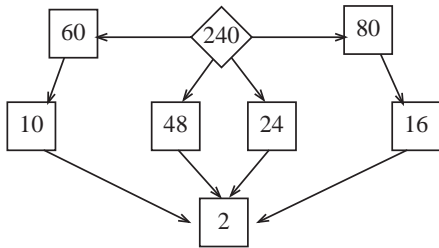


Practice Book *UNIT 1 Indices*

Answers

1.1 Multiplication and Division

1. (a) 29 (b) 44 (c) 56 (d) 68 (e) 152 (f) 266
(g) 150 (h) 300 (i) 120 (j) 22 (k) 31 (l) 19
(m) 20 (n) 56 (o) 85
2. (a) 35 (b) 63 (c) 64 (d) 48 (e) 28 (f) 56
(g) 72 (h) 40 (i) 54 (j) 9 (k) 5 (l) 9
(m) 7 (n) 7 (o) 7 (p) 7 (q) 9 (r) 8
3. (a) 67 (b) 21 (c) 36 (d) 72 (e) 189 (f) 28
(g) 20 (h) 17 (i) 4 (j) 10 (k) 12 (l) 9
(m) 21 (n) 35 (o) 60
4. 96p
5. 48 bottles
6. 20 chunks
7. 48 points
8. £9
9. 56 stamps
10. 8 heats
11. 7 teams
12. 
13. (a) 32 hot dogs
(b) $750 \text{ g} + (24 \times 256 \text{ g}) = 6894 \text{ g}$
14. Any three of: 1×30 , 2×15 , 3×10 , 5×6 (or reversals, e.g. 30×1 , etc.)
15. (a) 30 (b) 25

1.2 Squares, Cubes, Square Roots and Cube Roots

1. (a) 125 (b) 16 (c) 27 (d) 16 (e) 49 (f) 1
(g) 8 (h) 25 (i) 81 (j) 100 (k) 1000 (l) 64
(m) 343 (n) 36 (o) 64
2. (a) 2 (b) 3 (c) 6 (d) 2 (e) 9 (f) 7
(g) 10 (h) 4 (i) 12 (j) 8 (k) 11 (l) 5
(m) 5 (n) 10 (o) 13
3. (a) -1 (b) 0 (c) 150 (d) 5 (e) 14 (f) 32
(g) 5 (h) 3 (i) $\frac{1}{2}$ (j) 15 (k) 4 (l) 6
(m) 4 (n) 63 (o) 10

1.2

Answers

4. $2 \times 2 \times 2 \times 2 \times 2$ ($= 32$), $2 \times 2 \times 2 \times 2 \times 2 \times 2$ ($= 64$), $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ ($= 128$),
 $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ ($= 256$), $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ ($= 512$),...
 20th term = (1 048 576)

1.3 Index Notation

1. (a) 2^4 (b) 3^3 (c) 6^5 (d) 7^6 (e) 1^4 (f) $2^3 \times 5^2$ (g) 17^4
 (h) $5^3 \times 6^3$ (i) $3^2 \times 7^5$ (j) $2^2 \times 3^3 \times 5^2$ (k) $3^3 \times 5^2$ (l) $11^4 \times 13^2$
2. (a) 49 (b) 27 (c) 243 (d) 256 (e) 1 (f) 125
 (g) 64 (h) 216 (i) 1 (j) 1 000 000 (k) 1024 (l) 729
3. (a) 2^{12} (b) 3^{12} (c) 5^6 (d) 4^{10} (e) 7^9 (f) 2^9
 (g) $2^6 \times 5^4$ (h) $3^6 \times 4^7$ (i) 5^{13}
4. (a) $3^1 (= 3)$ (b) 7^3 (c) $2^0 (= 1)$ (d) 8^5 (e) 4^3 (f) $2^1 (= 2)$
 (g) 9^8 (h) 6^4 (i) 10^2 (j) 4^6 (k) 2^2 (l) 6^2
5. (a) 2^{10} or 4^5 (b) 3^5 (c) 5^3 (d) 6^3 (e) 2^9 or 8^3 (f) 13^2
 (g) 7^3 (h) 10^3 (i) 5^4 or 25^2 (j) 2^{11} (k) 17^2 (l) 11^3
6. (a) 2^6 (b) 3^9 (c) 5^4 (d) $(2^4)^2$ (e) 5^6 (f) $(4^3)^5$
 (g) $(10^3)^3$ (h) 7^8 (i) 2^2 (j) 3^3 (k) $(2^4)^4$ (l) 6^5
7. (a) a^7 (b) x^3 (c) b^2 (d) $a^1 = a$ (e) x^9 (f) x^{18}
 (g) a^4 (h) a^{12} (i) x^6 (j) b^6 (k) b^6 (l) a^2 (m) x^5
 (n) $a^0 = 1$ (o) $x^1 = x$
8. (a) 2^6 (b) 2^{20} 9. (i) 7^7 (ii) 7^6

1.4 Factors

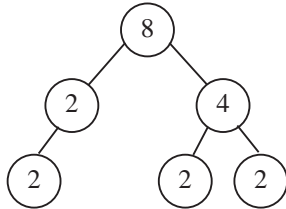
1. (a) 2, 5 (b) 2, 4 (c) 2, 4, 5 (d) 2, 4 (e) 5 (f) none
 (g) 2, 4, 5 (h) 5 (i) 2, 4 (j) 2, 4 (k) 2, 4 (l) 2, 5
2. (a) 3, 9 (b) 3, 9 (c) 3, 9 (d) 3, 9 (e) 11 (f) 3, 11
 (g) 3, 11 (h) 3, 11
3. (a) 1, 2, 4, 5, 10, 20 (b) 1, 2, 3, 4, 6, 8, 12, 24 (c) 1, 2, 4, 8, 16, 32
 (d) 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84 (e) 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
 (f) 1, 2, 3, 6, 17, 34, 51, 102 (g) 1, 3, 9, 27, 81 (h) 1, 2, 7, 14, 49, 98

1.4

Answers

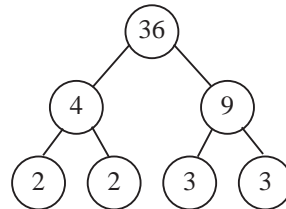
4. (a) 7 (b) 11 (c) 12 (d) 7 (e) 11 (f) 6
 (g) 13 (h) 5 (i) 11

5. (a)



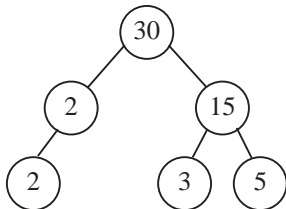
$$8 = 2 \times 2 \times 2$$

(b)



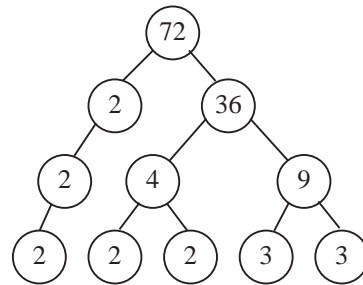
$$36 = 2 \times 2 \times 3 \times 3$$

(c)



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

(d)



$$72 = 2 \times 2 \times 2 \times 3 \times 3$$

1.5 Prime Factors

1. (a) 3, 7 (b) 2, 3, 11 (c) 2, 5, 7 (d) 2, 5, 7, 11 (e) 3, 5, 11
 (f) 2, 3 (g) 13 (h) 2, 3, 5, 7, 11 (i) 2, 5, 7, 13 (j) 2, 3, 7, 11, 13
 (k) 5, 7, 11 (l) 3, 5, 11
2. 101, 103, 107, 109, 113, 127, 131, 137, 139, 149, 151
 157, 163, 167, 169, 173, 179, 181, 191, 193, 197, 199
3. (a) $2 \times 3 \times 5^2$ (b) $2^2 \times 3 \times 5$ (c) $2^3 \times 3^2$ (d) $2^4 \times 3^2$ (e) $3^2 \times 5 \times 7$
 (f) $2 \times 3 \times 5 \times 7$ (g) $2^2 \times 71$ (h) $2^2 \times 3^2 \times 5$ (i) $2 \times 3^2 \times 5$ (j) $3 \times 7 \times 11$
 (k) $2 \times 3^2 \times 17$ (l) $2^2 \times 5^3$ (m) $2 \times 3^3 \times 13$ (n) $2 \times 3 \times 7^2 \times 11$
 (o) $2^3 \times 7 \times 11 \times 13$ (p) $2 \times 3^2 \times 5 \times 7 \times 13$
4. (a) $2^3 (= 8)$ (b) $3^3 (= 9)$ (c) $2 \times 7 (= 14)$ (d) $2 \times 3^2 (= 18)$
 (e) $2 \times 3 (= 6)$ (f) $2 \times 7 (= 14)$ (g) $3 \times 7 (= 21)$ (h) $3^2 \times 5 (= 45)$
 (i) $2^3 \times 7 (= 56)$ (j) $2^2 \times 7 (= 28)$ (k) $2^2 \times 3 (= 12)$ (l) $5 \times 7 (= 35)$
5. (a)

17

9

--

28

30

- (b) 4 or 16 or 36 or 64 or 100 or ... (i.e. any even square number)

1.5

Answers

6. (a) (i) $72 = 2^3 \times 3^2$ (ii) $80 = 2^4 \times 5$
 (b) The lowest common multiple of 72 and 80 is $2^4 \times 3^2 \times 5 = 720$
 Hence they will be next level after 720 seconds or 12 minutes.
7. (a) $2 \times 3 \times 3$ (b) 36

1.6 Further Index Notation

1. (a) 7 (b) 3 (c) 2 (d) 2 (e) 10 (f) 27
 (g) 8 (h) 25 (i) 16 (j) 6 (k) 8 (l) 11
 (m) 9 (n) 27 (o) 100 (p) 8 (q) 8 (r) 32
 (s) 3 (t) 0.2 (u) 16 (v) $\frac{1}{2}$ (w) $\frac{1}{3}$ (x) $\frac{1}{2}$
 (y) $\frac{1}{16}$ (z) $\frac{1}{64}$
2. (a) $\frac{1}{2}$ (b) 4 (c) $\frac{1}{3125}$ (d) 2 (e) 1 (f) $\frac{25}{16}$
 (g) $\frac{49}{16}$ (h) $\frac{64}{25}$ (i) $\frac{27}{8}$ (j) 1 (k) $\frac{32}{243}$ (l) $\frac{169}{6}$
3. (a) a^8 (b) a^5 (c) $3a^3$ (d) x^8 (e) x^5 (f) a^2
 (g) a^{-1} (h) a^{-1} (i) a^{-8} (j) $a^0 = 1$ (k) a^2 (l) a^{-4}
4. (a) 4 (b) 3 (c) 3 (d) 2 (e) 5 (f) 6
 (g) 3 (h) 4 (i) 2 (j) 3 (k) 2 (l) 3
 (m) 4 (n) 9 (o) $\frac{1}{4}$ (p) $\frac{1}{25}$ (q) 0 (r) 0
5. (a) $a^{\frac{14}{15}}$ (b) $a^{\frac{1}{5}}$ (c) $a^{\frac{1}{15}}$ (d) $a^{\frac{13}{28}}$ (e) $a^{\frac{5}{8}}$ (f) $a^{\frac{4}{3}} b^{\frac{1}{6}}$
 (g) $a^{\frac{7}{6}} b^{\frac{11}{12}}$ (h) $a^{\frac{11}{12}}$ (i) $a^{\frac{13}{14}}$
6. $3^{-2}, 2^{-3}, \left(\frac{1}{4}\right)^{\frac{1}{2}}$
7. (a) 2 (b) $\frac{1}{16}$ (c) $\frac{1}{3}$
8. (a) 32 (b) -5 (c) $\frac{1}{27}$
9. (a) 6 (b) 3 (c) -2 (d) 4
10. (a) p^7 (b) $4t^3$
11. (a) 9.16 (to 2 d.p.) (b) 74.088

1.7

Answers

1.7 Standard Form

1. (a) 4×10^3 (b) 5.6×10^2 (c) 7×10^5 (d) 5×10^1 (e) 4.213×10^3
 (f) 2.7×10^3 (g) 2.36×10^2 (h) 2.36×10^3 (i) 1.2×10^{-1} (j) 7×10^{-3}
 (k) 1.007×10^{-1} (l) 1.2×10^{-4} (m) 2×10^6 (n) 1×10^5
 (o) 5.62005×10^5 (p) 2.3006×10^1 (q) 4.703×10^2 (r) 3.002×10^{-3}
2. (a) 320 (b) 4670 (c) 13 (d) 5 632 000 (e) 67 200
 (f) 12 400 (g) 0.03612 (h) 0.147 (i) 6530 (j) 0.007124
 (k) 0.00653 (l) 0.0000134 (m) 0.0000325 (n) 0.06183 (o) 9 990 000
 (p) 275 000 000 (q) 0.00275 (r) 0.04216
3. (a) yes (b) no: 4.276×10^3 (c) yes (d) no: 7.82×10^{-4}
 (e) no: 5.16×10^0 (f) yes (g) no: 8.271×10^0 (h) no: 1×10^{-4} (i) yes
4. $5.1 \times 10^8 \text{ km}^2$
5. 5.87×10^7
6. (a) $3 \times 10^8 \text{ m/s}$ (b) $\frac{(3 \times 10^8)}{(3 \times 10^2)} = 1 \times 10^6$
7. $\frac{(2.5 \times 10^6)}{(6.18 \times 10^2)} = 4.0 \times 10^3$ people per square kilometre
8. 5.93×10^9 or 5.9×10^9

1.8 Calculations with Standard Form

1. (a) 3.1×10^4 (b) 2.5×10^4 (c) 6×10^4 (d) 1.27×10^3
 (e) 8×10^5 (f) 1.5×10^7 (g) 2×10^2 (h) 3×10^9
 (i) 1.3×10^7 (j) 3×10^{-1} (k) 4×10^3 (l) 4×10^2
 (m) 1×10^3 (n) 6.8×10^{-1} (o) 1×10^{-4} (p) 1.2×10^1
2. 8.4×10^{-3}
3. 7.6×10^{-3}
4. 7.5×10^{-7}
5. (a) 1.6×10^{14} (b) 6.4×10^{-2} (c) 2.5×10^{15} (d) 4.096×10^{-3}
6. $3.333 \dots \times 10^{-7}$
7. $C = 1.759 \dots \times 10^{-6} \text{ cm}$; $A = 2.463 \dots \times 10^{-13} \text{ cm}^2$

1.8

Answers

8. (a) 9.66×10^5 (b) 6.823×10^4 (c) 7.751×10^3 (d) 2.23×10^{23}
 (e) 3.259×10^7 (f) 1.903×10^{-2} (g) 1.212×10^0 (h) 3.466×10^{-6}
 (i) 1.292×10^1 (j) 1.692×10^1
9. 1.2×10^{-2}
10. (a) 4.1184×10^{-2} (b) 1.018×10^0
11. (a) 2.5×10^6 (b) 2.5×10^{11} (c) 4×10^{-6} (d) 1.4×10^{-8}
12. 3.96×10^8
13. 1.322×10^9 km
14. (a) 1.23×10^{13} km (b) 3.25 (c) 2.44×10^5 mps
15. 1.299×10^{-11} kg/m³
16. (a) 5.76×10^7 square miles (b) 29.2%
17. 2.5125×10^{-21}
18. (a) (i) 6×10^4 (ii) 3.6×10^9 (b) 3.13×10^{-2}
19. (a) 10^6 millions (b) 8×10^9 (c) 2.4×10^{22}