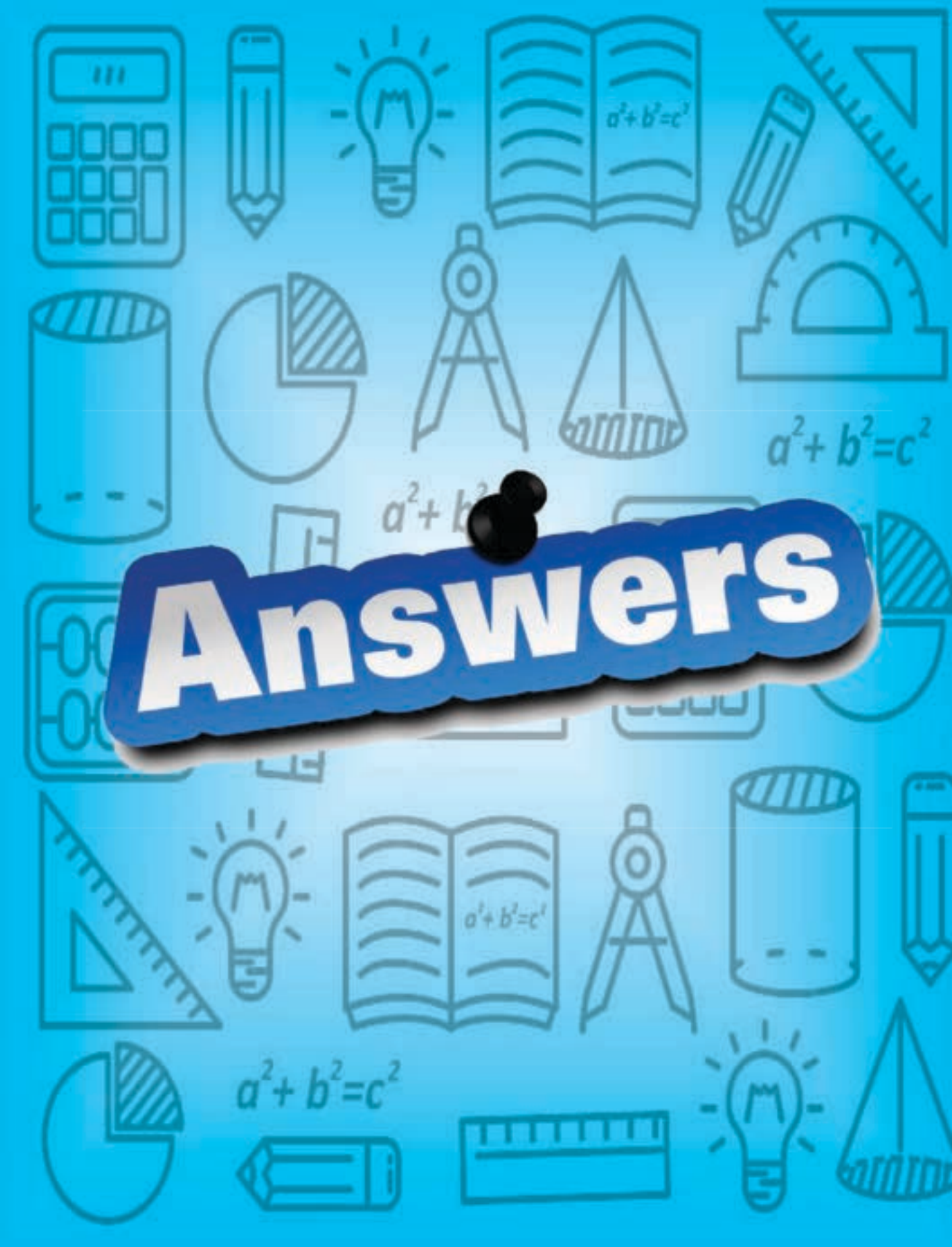

Answers

## Exercise 1.1

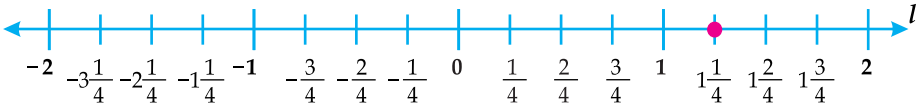
**1.**
- **i.** Rational number
- **ii.** Irrational number
- **iii.** Irrational number
- **iv.** Rational number
- **v.** Irrational number
- **vi.** Irrational number
- **vii.** Rational number
- **viii.** Irrational number
- **ix.** Irrational number
- **x.** Rational number
- **xi.** Irrational number
- **xii.** Rational number

**2.**
- **i.** Terminating
- **ii.** Non-terminating
- **iii.** Non-terminating
- **iv.** Terminating
- **v.** Terminating
- **vi.** Non-terminating

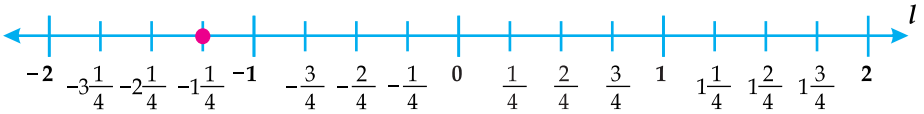
**3.** **i.**


**ii.**


**iii.**




**iv.**




**v.**


**vi.**

**4.** We can not make list of all real numbers between 1 and 2.

**5.** Pi ($\pi$) is an irrational number because it is non terminating and non recurring decimal.

**6.** **i.** False **ii.** True **iii.** True **iv.** True **v.** True **vi.** False

## Exercise 1.2

**1.**
- **i.** Commutative property of addition.
- **ii.** Associative property of addition.
- **iii.** Left distributive property of multiplication over addition.
- **iv.** Right distributive property of multiplication over addition.
- **v.** Right distributive property of multiplication over subtraction.
- **vi.** Commutative property of multiplication.
- **vii.** Associative property of multiplication.
- **viii.** Multiplicative inverse.
- **ix.** Additive inverse.
- **x.** Multiplicative inverse.
- **xi.** Left distributive property of multiplication over subtraction.
- **xii.** Multiplicative inverse.

**2.** **i.** $\frac{\sqrt{2}}{5}+\frac{3}{\sqrt{6}}=\frac{\boxed{3}}{\sqrt{6}}+\frac{\sqrt{2}}{\boxed{5}}$ **ii.** $\frac{7}{10}+\left(\frac{70}{\boxed{10}}+\frac{16}{33}\right)=\left(\frac{7}{\boxed{10}}+\frac{\boxed{70}}{10}\right)+\frac{16}{\boxed{33}}$

**iii.** $\frac{99}{50}\times\frac{50}{99}=\boxed{1}$ **iv.** $\frac{59}{95}\times\frac{95}{59}=\boxed{1}$

**v.** $(-21)+\left(\boxed{21}\right)=0$ **vi.** $\frac{5}{8}\times\left(\frac{2}{3}+\frac{5}{7}\right)=\left(\frac{\boxed{5}}{8}\times\frac{2}{3}\right)+\left(\frac{5}{8}\times\frac{\boxed{5}}{7}\right)$

**3.** **i.** $5<10$ **ii.** $10>5$ **iii.** $6+9$
**iv.** $6+8$ **v.** $6+6$

**4.** **i.** $7\times12$ **ii.** $5\times12$ **iii.** $<$ **iv.** $>$

**5.**

| | Additive inverse | multiplicative inverse. |
|---|---|---|
| i. | $-3$ | $\frac{1}{3}$ |
| ii. | $7$ | $\frac{-1}{7}$ |
| iii. | $-0.3$ | $\frac{1}{0.3}$ |
| iv. | $\frac{\sqrt{5}}{5}$ | $\frac{-5}{\sqrt{5}}$ |
| v. | $\frac{-9}{\sqrt{12}}$ | $\frac{\sqrt{12}}{9}$ |
| vi. | $0$ | does not exist |

## Exercise 1.3

**1.** i. Radicand $= 5$, Index $= 3$

ii. Radicand $= \frac{x}{y}$, Index $= 4$

iii. Radicand $= x^2yz$, Index $= 5$

iv. Radicand = ab, index =2

v. Radicand = $\frac{pq}{r}$, index =n

**2.** i. $\left(\frac{3}{4}\right)^{\frac{1}{2}}$ ii. $\left(\frac{x}{y}\right)^{\frac{5}{2}}$ iii. $\left(\frac{x}{y}\right)^{\frac{5}{3}}$ iv. $(yz)^{\frac{7}{3}}$ v. $(27)^{\frac{1}{9}}$

vi. $(-64)^{\frac{2}{3}}$ vii. $\left(\frac{1}{2}\right)^{\frac{m}{3}}$ viii. $(xy)^{\frac{3}{5}}$ ix. $\left(\frac{4}{3}\right)^{\frac{1}{6}}$

**3.** i. $\sqrt[7]{(5)^3}$ ii. $\sqrt[3]{\frac{a}{b^2}}$ iii. $\sqrt[7]{\left(\frac{5}{7}\right)^{15}}$ iv. $\sqrt{\left(\frac{a}{b}\right)^m}$ v. $\sqrt[5]{\left(\frac{11}{13}\right)\left(\frac{12}{13}\right)}$

## Exercise 1.4

**1.** i. 27 ii. 20 iii. $(a+b)(c+d)$

**2.** i. $\left(\frac{1}{3}\right)^9$ ii. $\left(\frac{3}{4}\right)^7$ iii. $\left(\frac{4}{5}\right)^8$ iv. $-3^3 \times 5^6$ v. $3^3 \times 4^6$

vi. $\frac{a^9}{b^9 c^9}$ vii. $\frac{c^{10}}{d^{10}}$ viii. $m^6 n^5 t^{11}$ ix. $a^9 b^6 c^8$

**3.** i. $5^6$ ii. $x^{15} y^{15}$ iii. $(4)^{10}$ iv. $-3^9 \times 4^6$ v. $\frac{b^6}{5^3}$

vi. $\frac{(4)^6}{9^6}$ vii. $z^{24}$ viii. $m^{100}$ ix. $-(0.1)^{18}$

## Exercise 1.5

**1.** i. $1+2i$ ii. $2+2i$ iii. $4i$

iv. $-1+i$ v. $-2$ vi. $-3+4i$

**2.** i. $\text{Re}(z)=1,\ \text{Im}(z)=2$ ii. $\text{Re}(z)=4,\ \text{Im}(z)=9$

iii. $\text{Re}(z)=-5,\ \text{Im}(z)=6$ iv. $\text{Re}(z)=-1,\ \text{Im}(z)=-1$

v. $\text{Re}(z)=\frac{-3}{4},\ \text{Im}(z)=\frac{4}{5}$ vi. $\text{Re}(z)=-1,\ \text{Im}(z)=2$

**3.** i. $\bar{z}=3-2i$ ii. $\bar{z}=(0,7)$ iii. $\bar{z}=(-1,0)$

iv. $\bar{z}=1+i$ v. $\bar{z}=\frac{-3}{4}+\frac{4}{5}i$ vi. $\bar{z}=1-3i$

**5.** i. $x=-5, y=5$ ii. $x=\pm\frac{4}{3}$, $y=\pm\frac{3}{5}$

iii. $x=\frac{-27}{5}, y=\pm 11$ iv. $x=\frac{9\sqrt{30}}{\sqrt{5}}, y=\frac{-4}{27}$

## Exercise 1.6

**1.** i. $(12,5)$ ii. $\left(\frac{13}{6},\frac{13}{6}\right)$ iii. $(5,21)$

iv. $\left(0,-\frac{1}{15}\right)$ v. $(5,0)$ vi. $(0,-41)$

vii. $\left(\frac{3-6\sqrt{2}}{4},\frac{3+3\sqrt{2}}{2\sqrt{2}}\right)$ viii. $\left(\frac{-5}{13},\frac{-27}{13}\right)$

**2.** i. $\frac{-1}{2}+\frac{1}{2}i$ ii. $-4$ iii. $-\frac{i}{2}$ iv. $16$

## Review Exercise 1

**1.** i. $\frac{1}{\sqrt{5}}$ ii. Set of real numbers iii. 0
iv. 7 v. 0 vi. Irrational
vii. rational viii. $-3-5i$ ix. 2
x. (ac – bd, ad + bc)

**2.** i. True ii. True iii. True iv. True v. True

**3.** i. $a$ ii. $b$ iii. $c$ iv. $b$

**4.** i. 2 ii. $\frac{1}{3}$ **5.** i. $3^{21}$ ii. $2^{36}$

**6.** i. 7 ii. $-1$ iii. $7+i$ iv. $5\sqrt{2}$ v. $\frac{7}{50}+\frac{1}{50}i$
vi. $\frac{1}{5\sqrt{2}}$ vii. $1+7i$ viii. $-1+7i$

## Exercise 2.1

**1.** i. $9.7\times10^{3}$ ii. $4.98\times10^{6}$ iii. $9.6\times10^{7}$ iv. $4.169\times10^{3}$
v. $8.4\times10^{4}$ vi. $7.18\text{x}10^{-1}$ vii. $6.43\text{x}10^{-3}$ viii. $7.4\text{x}10^{-3}$
ix. $2.1005\text{x}10^{-1}$

**2.** i. 70000 ii. 0.0000000008072 iii. 6018000 iv. 786500000
v. 0.000205 vi. 72500000000 vii. 4502000 viii. 0.00000002865
ix. 3056000

## Exercise 2.2

**1.** i. $\log_7 343=3$ ii. $\log_3\frac{1}{81}=-4$ iii. $\log_{10}(0.001)=-3$
iv. $\log_8(4)=\frac{2}{3}$

**2.** i. $(27)^{\frac{4}{3}}=81$ ii. $(2)^{-3}=\frac{1}{8}$ iii. $10^{\circ}=1$ iv. $(10)^{-2}=0.01$

**3.** i. $x=4\sqrt{2}$ ii. $a=9$ iii. $y=4$ iv. $x=8$
v. $y=2$ vi. $a=4$ vii. a is any positive real number
viii. $y=1$ ix. $x=1$

## Exercise 2.3

**1.** i. Characteristic : 0, Mantissa : 0.9031 ii. Characteristic : 3, Mantissa : 0.7036 iii. Characteristic : 0, Mantissa : 0.9997
iv. Characteristic : 2, Mantissa : 0.8839 v. Characteristic : –3, Mantissa : 0.5172 vi. Characteristic : –5, Mantissa : 0.4771

**2.** i. 0.9542 ii. 1.7448 iii. 1.4711 iv. 2.6078
v. $\overline{3}.6712$ vi. $\overline{5}.8808$

**3.** i. 0.4926 ii. 2.4926 iii. $\overline{3}.4926$ iv. 3.4926
v. 2.4926 vi. 5.4926

## Exercise 2.4

**1.** i. 3692 ii. 0.5530 iii. 2.278
iv. 653800 v. 0.0002425 vi. 8.292

**2.** i. 2.954242509 ii. 1.658393026 iii. 4.563267445
iv. 2.917137753 v. –2.07007044 vi. – 4.013228266

**3.** i. 56.2989 ii. 4.5803 iii. 0.024367
iv. 3019.95 v. 0.0000000991 vi. 1.8471

## Exercise 2.5

**1.** i. $\log_a x+\log_a y+\log_a z$ ii. $2\log_a x+\log_a y$

iii. $\log_a x+\log_a y-\log_a z$ iv. $\frac{1}{2}\log_a x+\frac{1}{2}\log_a y$

v. $-\frac{1}{2}\log_a x-\frac{1}{2}\log_a y-\frac{1}{2}\log_a z$ vi. $3\log_a x+\log_a y-2\log_a z$

vii. $\frac{1}{2}\log_a x+\log_a y+\frac{1}{2}\log_a z$ viii. $\frac{-7}{12}\log_a(x)-\log_a y$

ix. $\frac{-2}{3}\log_a x+\frac{3}{2}\log_a y-\frac{2}{3}\log_a z$

**2.** i. $\log_a(2\sqrt{2})$ ii. $\log_a(x^2-1)$ iii. $\log\frac{(x+1)^2}{x(x-1)}$

**3.** i. 1.1761 ii. 1.8062 iii. 0.5 iv. 1.6812
v. 0.6276 vi. 1.4771 vii. 0.4260 viii. 0.4604

## Exercise 2.6

**1.** i. 253.688 ii. 6750 iii. 48.2176 iv. $x = 930.80$
v. 15.20 vi. 1.2585 vii. 410130 viii. $1.84077 \times 10^{13}$

**2.** i. 8 ii. 22 iii. 15 iv. 14 v. 29

## Review Exercise 2

**1.** i. False ii. False iii. True iv. False v. True

**2.** i. Common logarithm ii. 0 iii. Mantissa
iv. 9 v. $\log_a n$ vi. $a^x = y$
vii. $\log_a y = 10$ viii. 1 ix. $\log_a m - \log_a n$
x. 2 xi. 0 xii. $-5$

**3.** i. *d* ii. *b* iii. *b* iv. *b* v. *a*
vi. *c* vii. *c* viii. *b* ix. *b* x. *c*

## Exercise 3.1

**1.** i. Polynomial ii. Not a polynomial iii. Polynomial
iv. Not a polynomial v. Not a polynomial vi. Not a polynomial

**2.** i. Rational ii. Not a rational iii. Rational
iv. Not a rational v. Rational vi. Not a rational

**3.** i. p–10 ii. $\frac{a}{a+b}$ iii. $\frac{a}{2(a+b)}$

iv. $x+y-z$ v. $\frac{3m(m+5)}{2}$ vi. $\frac{x-3}{x-2}$

**4.** i. $\frac{4x^2-1}{x^2-1}$ ii. $\frac{3x+7}{(x+2)(x+3)}$ iii. $\frac{2\ x^2y^2+xy+1}{(xy+1)(xy-1)}$

iv. $\frac{-15}{(x+3)\ (x+6)}$ v. $\frac{-2b}{a^2-b^2}$ vi. $\frac{-(y-1)}{y+1}$

**5.** i. $\frac{8y^3}{(2y-x)^2\ (2y+x)}$ ii. $-\frac{2x+3y}{y}$ iii. 1

iv. $\frac{5}{3}$ v. $\frac{(q-5)(q+3)}{q^2}$ vi. $\frac{8(z-1)}{z-5}$

**6.** $\frac{2\left(x^2+y^2\right)}{x^2-y^2}$

**7.** i. $\frac{1}{6}$ ii. $9\frac{9}{55}$ iii. $-\frac{17}{73}$

iv. $-4\frac{4}{9}$ v. $1\frac{1}{11}$

## Exercise 3.2

**1.** $a^2+b^2=50,\ ab=7$ **2.** $a^2+b^2=17,\ ab=4$ **3.** $a^2+b^2+c^2=55$

**4.** $a^2+b^2+c^2=\frac{5}{9}$ **5.** $a+b+c=\pm 7$ **6.** $a+b+c=\pm\sqrt{2.5}$

**7.** $ab+bc+ca=40$ **8.** $a^3+b^3=28$ **9.** $ab=-8$

**10.** $ab=-4$ **11.** $a^3-b^3=230$ **12.** $125x^3+y^3=247$

**13.** $216a^3-343\,b^3=12419$ **14.** $x^3+\frac{1}{x^3}=322$ **15.** $x^3-\frac{1}{x^3}=1364$

**16.** i. $\frac{27b^3}{8}+\frac{8}{27b^3}$ ii. $\frac{343y^6}{729}+\frac{729}{343y^6}$

iii. $\frac{x^{12}}{1728}-\frac{1728}{x^{12}}$ iv. $c^6-\frac{1}{c^6}$

**17.** i. $8x^6+27y^6$ ii. $8x^6-27y^6$

iii. $x^{12}-y^{12}$ iv. $256x^8-6561y^8$

## Exercise 3.3

**1.** i. $\frac{3z}{x^2}$ ii. $4\sqrt[3]{4}a^2b^4c^3$ iii. 2 iv. $36\sqrt{6}$

v. $\frac{25}{32}$ vi. $\frac{14\sqrt{3}}{11}$ vii. 6 viii. 2

**2.** i. $8+4\sqrt{3}$ ii. $6\sqrt{6}-2\sqrt{3}$ iii. $8\sqrt{12}-\sqrt{8}$ iv. $2+\sqrt{3}$

**3.** i. $66\sqrt{2}$ ii. $13\sqrt{5}$ iii. $20+9\sqrt{3}$ iv. $15\sqrt{10}$

v. $4\sqrt{5}+25$ vi. $\sqrt{11}$ vii. 136 viii. $3\sqrt{2}$

ix. $\frac{1}{3}$ x. 2 xi. $134-24\sqrt{30}$ xii. $30+12\sqrt{6}$

## Exercise 3.4

**1.** i. $2-\sqrt{3}$ ii. $3-2\sqrt{2}$ iii. $-\left(\frac{5\sqrt{2}+4\sqrt{3}}{2}\right)$

iv. $16\left(2\sqrt{3}-11\right)$ v. $\frac{83-18\sqrt{2}}{79}$ vi. $\frac{11+3\sqrt{3}}{2}$

**2.** i. $\left(x+\frac{1}{x}\right)^2=256$ ii. $x=-\left(\frac{4\sqrt{7}+11}{9}\right)$

iii. $x+\frac{1}{x}=6, x-\frac{1}{x}=-4\sqrt{2}, x^2+\frac{1}{x^2}=34, x^2-\frac{1}{x^2}=-24\sqrt{2}, x^4+\frac{1}{x^4}=1154$

**3.** 322 **4.** 194 **5.** $112\sqrt{3}$

## Review Exercise 3

**1.** i. *b* ii. *b* iii. *a*
iv. *a* v. *a* vi. *a*
vii. *b* viii. *a* ix. *a*
x. *a* xi. *a* xii. *b*

**2.** i. Highest power or exponent on the variable
ii. $2+\sqrt{3}$ iii. 4
iv. Irrational expression v. $x^4-y^4$

## Exercise 4.1

**1.** i. $4(x+4y+6z)$ ii. $x^2(1+3y+4y^2z)$
iii. $3pq(r+2t+s)$ iv. $9qr(s^2+t^2)(1+2qr)$
v. $\frac{xz^2}{4}\left(\frac{1}{4}-\frac{x}{2}+\frac{xz}{3}\right)$ vi. $a(x-y)(1-ab+ab^2)$

**2.** i. $(7+z)(x+z)$ ii. $3(3ab-2c)(a+2b)$
iii. $2(t-2p)(3+2q)$ iv. $(r+9s)(r-7s)$

v. $(1-z)\left(\frac{y^2}{4}-\frac{z^2t}{9}\right)$ vi. $\frac{1}{11}(2y+z)(5x-7y)$

3. i. $(2a+3b)^2$ ii. $\left(6x^2+1\right)^2$

iii. $\left(x+\frac{1}{2x}\right)^2$ iv. $(9y+8z)^2$

v. $\left(25+a^2b\right)^2$ vi. $(a+0.2)^2$

4. i. $\left(b^2-2c^2\right)^2$ ii. $\left(\frac{3x^2}{2}-\frac{2}{3x^2}\right)^2$

iii. $2ab^3(a-4b)^2$ iv. $(3p + 3q - r^2)^2$

v. $(xy-0.05)^2$ vi. $(a - b - 9)^2$

5. i. $(2a-3b)(2a+3b)$ ii. $(4x-5y)(4x+5y)$

iii. $\left(10xz+y^2\right)\left(10xz-y^2\right)$ iv. $\left(\frac{x^2}{10}+10y^2\right)\left(\frac{x^2}{10}-10y^2\right)$

v. $\left(\frac{8f}{9}-\frac{9g^2}{8}\right)\left(\frac{8f}{9}+\frac{9g^2}{8}\right)$ vi. $\left(\frac{x^2}{11}-11y\right)\left(\frac{x^2}{11}+11y\right)$

6. i. $8xz$

ii. $4(3a - 2b)(a - 7b)$

iii. $(13x^2 - 3t - 4)(13x^2 + 3t + 4)$

iv. $(13x^2 - 5y^2)(5x^2 - 3y^2)$

v. $\left(a+\frac{1}{a}+b-\frac{1}{b}\right)\left(a+\frac{1}{a}-b+\frac{1}{b}\right)$

vi. $\left(3x+\frac{1}{3x}+2y-\frac{1}{2y}\right)\left(3x+\frac{1}{3x}-2y+\frac{1}{2y}\right)$

7. i. $(x + y - 3z^2)(x + y + 3z^2)$ ii. $(2a + 2b^2 - 3c)(2a + 2b^2 + 3c)$

iii. $(4d^2 - c^2 + d)(4d^2 + c^2 - d)$ iv. $(2x + 2y^2 + 3y^3)(2x + 2y^2 - 3y^3)$

v. $(x+y-1)\,(x-y-z)$ vi. $(2x+y+1)\,(2x-y-1)$

8. i. $\left(\sqrt{ab}-\sqrt{c}\right)\left(\sqrt{ab}+\sqrt{c}\right)$ ii. $\left(2\sqrt{x}-3\sqrt{y}\right)\left(2\sqrt{x}+3\sqrt{y}\right)$

iii. $\left(\sqrt{yz}-\frac{1}{\sqrt{yz}}\right)\left(\sqrt{yz}+\frac{1}{\sqrt{yz}}\right)$ iv. $\left(\sqrt{xzt}-\frac{1}{\sqrt{t}}\right)\left(\sqrt{xzt}+\frac{1}{\sqrt{t}}\right)$

## Exercise 4.2

1. i. $\left(a^2+x^2+ax\right)\left(a^2+x^2-ax\right)$ ii. $\left(b^2-b+1\right)\left(b^2+b+1\right)$

iii. $(a^2+x^2-ax)\,(a^2+x^2+ax)\,(a^4+x^4-a^2x^2)$

iv. $\left(z^2+z+1\right)\left(z^2-z+1\right)\left(z^4-z^2+1\right)$

2. i. $\left(x^2+2xy+2y^2\right)\left(x^2-2xy+2y^2\right)$ ii. $9\left(2x^2z^2+2xyz+y^2\right)\left(2x^2z^2-2xyz+y^2\right)$

iii. $\left(2t^2+10t+25\right)\left(2t^2-10t+25\right)$ iv. $\left(2t^2+2t+1\right)\left(2t^2-2t+1\right)$

3. i. $(x-2)(x+5)$ ii. $(ab+2)(ab-5)$

iii. $(y-7)(y+14)$ iv. $(xyz-4)(xyz+6)$

4. i. $(3y+8z)\,(3y-z)$ ii. $2\,(7x+1)\,(3x-1)$

iii. $(2x+1)(2x+5)$ iv. $(3x+y)(x-13y)$

## Exercise 4.3

1. i. $(x-2)^2\,(x-7)\,(x+3)$ ii. $\left(x^2+5x+3\right)\left(x^2+5x+7\right)$

iii. $(x-3)\,(x+1)\,\left(x^2-2x+10\right)$ iv. $\left(x^2-8x+1\right)\left(x^2-8x-1\right)$

v. $\left(x^2+9x-2\right)\left(x^2+9x+6\right)$ vi. $(x-6)\,(x+1)\left(x^2-5x+16\right)$

**2.** i. $(x^2+5x-2)(x^2+5x+12)$ ii. $(x^2+7x+16)(x+6)(x+1)$

iii. $(x^2-5x+15)(x^2-5x-5)$ iv. $(x^2-12x+30)(x-8)(x-4)$

v. $(x^2-5x-10)(x^2-5x+20)$ vi. $(x^2-7x+27)(x^2-7x-5)$

**3.** i. $(x+\sqrt{3})(x-\sqrt{3})(x+2\sqrt{3})(x-2\sqrt{3})$

ii. $(x^2+1)(x+\sqrt{14})(x-\sqrt{14})$ iii. $(x+\sqrt{3})^2(x-\sqrt{3})^2$

iv. $(x+\sqrt{2})(x-\sqrt{2})(x+4\sqrt{2})(x-4\sqrt{2})$

v. $(x+\sqrt{5})(x-\sqrt{5})(x+2\sqrt{5})(x-2\sqrt{5})$ vi. $(x+2\sqrt{3})(x-2\sqrt{3})(x^2-2x-12)$

## Exercise 4.4

**1.** i. $(b+c)^3$ ii. $(2x+y)^3$ iii. $\left(4x+\frac{1}{4}\right)^3$

iv. $(2x+3)^3$ v. $\left(\frac{1}{3}+y^2\right)^3$ vi. $\left(\frac{2}{3}x+\frac{3}{2}y\right)^3$

vii. $\left(\frac{4}{3}+x\right)^3$ viii. $\left(\frac{z}{2}+\frac{y}{3}\right)^3$

**2.** i. $(d-2c)^3$ ii. $\left(x^2-\frac{4}{3}\right)^3$ iii. $\left(\frac{x}{5}-y\right)^3$

iv. $\left(5z-y^2\right)^3$ v. $\left(\frac{z}{3}-6y\right)^3$ vi. $\left(\frac{b^2}{3}-\frac{c^2}{2}\right)^3$

vii. $\left(6-\frac{z}{2}\right)^3$ viii. $\left(\frac{2}{3}x-\frac{3}{2}y\right)^3$

## Exercise 4.5

**1.** i. $(x+2y)(x^2-2xy+4y^2)$ ii. $a^2(a+b)(a^2-ab+b^2)(a^6-a^3b^3+b^6)$

iii. $(a^2+1)(a^4-a^2+1)$ iv. $(ab+8)(a^2b^2-8ab+64)$

v. $b^3(a+3b)(a^2-3ab+9b^2)$ vi. $\left(\frac{x}{5}+\frac{5}{x}\right)\left(\frac{x^2}{25}-1+\frac{25}{x^2}\right)$

vii. $x^3\,(x^2+y^2z^3)\,(x^4-x^2y^2z^3+y^4z^6)$

viii. $\left(\frac{x^2}{3}+\frac{2}{x}\right)\left(\frac{x^4}{9}-\frac{2x}{3}+\frac{4}{x^2}\right)$

**2.** i. $(x-2y)(x^2+2xy+4y^2)$ ii. $(x^3-2y^3)(x^6+2x^3y^3+4y^6)$

iii. $\left(10-\frac{xy}{5}\right)\left(100+\ xy+\frac{x^2y^2}{25}\right)$

iv. $(a+b)(a^2-ab+b^2)(a-b)(a^2+ab+b^2)$

v. $\left(\frac{x}{2}+\frac{2}{x^2}\right)\left(\frac{x^2}{4}-\frac{1}{x}+\frac{4}{x^4}\right)\left(\frac{x}{2}-\frac{2}{x^2}\right)\left(\frac{x^2}{4}+\frac{1}{x}+\frac{4}{x^4}\right)$

vi. $(x-y)\,(x+y)\,(x^2+y^2)\,(x^4+y^4-x^2y^2)\,(x^2+y^2+xy)\,(x^2+y^2-xy)$

vii. $\left(\frac{3}{x}-2y^2\right)\left(\frac{9}{x^2}+\frac{6y^2}{x}+\ y^4\right)$ viii. $\left(2x^2-\frac{1}{9}\right)\left(4x^4+\frac{2x^2}{9}+\frac{1}{81}\right)$

## Exercise 4.6

**1.** i. $R=-2$ ii. $R=2$ iii. $R=18$ iv. $R=-42$ v. $R=-11$

vi. $R=\frac{3}{2}$ vii. $R=-8$ viii. $R=3y^4$

**2.** $m=-1$ **3.** $k=-24$ **4.** $r=-1,\ r=3$

## Exercise 4.7

**1.** i. $R=0,\ q(x)=x^2+1$ ii. $R=-2,\ q(x)=x^2-2x+1$

iii. $R=-60,\ q(x)=x^2-8x+27$ iv. $R=4,\ q(x)=x^2+8x+5$

v. $R=29,\ q(x)=x^3-3x^2+7x-15$ vi. $R=1,\ q(x)=x^3+2x^2+x+2$

vii. $R=-291,\ q(x)=x^4-3x^3+10x^2-32x+96$

viii. $R=174,\ q(x)=x^4+2x^3+7x^2+18x+60$

ix. $R=175,\ q(x)=2x^3+2x^2+104x+40$

x. $R = -300,\ q(x) = 6x^3 - 42x^2 + 90x - 114$

**2.** $k = 24$ **3.** $m = 4$ **4.** $m = -24$ **5.** $m = -1$

## Exercise 4.8

**1.** i. $(x-1)(x^2+1)$ ii. $(x+1)^2(x-1)$

iii. $(x-1)(x-2)(x-3)$ iv. $(x+2)(x-2)(x+5)$

v. $(x-2)(x^2+9)$ vi. $(x+1)(2x-1)(3x+2)$

vii. $(x+1)(x+3)(x+4)$ viii. $(x+1)(2x+1)(x+3)$

ix. $(x+2)(x+4)(x+6)$

## Review Exercise 4

**1.** i. True ii. True iii. True iv. False

v. False vi. False

**2.** i. $4x + y^2$ ii. $x^2 + 4xy + 16y^2$ iii. $x + 3$

iv. $2xy$ v. $a^2 - 3ab + 9b^2$

**3.** i. $b$ ii. $c$ iii. $d$ iv. $a$ v. $b$ vi. $c$

## Exercise 5.1

**1.** i. HCF = $24x^3y^5z^2$ ii. HCF = $6r^3s^3t^3$

iii. HCF = $(x+3)$ iv. HCF = $(2x-3)$

v. HCF = $2(a-2b)$ vi. HCF = $(x+1)$

**2.** i. HCF = $(x+1)$ ii. HCF = $(x^2 + 7x + 12)$

iii. HCF = $(x-2)$ iv. $x^2 + 3x + 1$

**3.** i. LCM = $81a^4b^5c^8$ ii. $600p^5q^4r^8$

iii. $7x(x-1)(3x-2)$ iv. $(x+4)(x+7)(x-3)$

v. $(3x + 1)(x - 1)(2x + 3)$

vi. $(x+y)(x-y)(x^2+xy+y^2)(x^2-xy+y^2)$

4. i. $(x-20)(x-5)(x+4)$ ii. $(3x+2)(x+4)(2x-1)$

iii. $(x+y+z)(x-y-z)(y-z-x)$ iv. $12x^3(x-4)(x+7)(x-2)$

5. $(x-8)(x^2-6x+6)$ 6. $x^2+2x-3$

7. $9x^4+15x^3-12x-14x^2+8$ 9. 6 cm

10. 11 : 54 am

## Exercise 5.2

1. i. $\frac{7x+3}{(x+1)^2}$ ii. $\frac{12x^2+29x+16}{3x(2x+1)(x+1)}$

iii. $\frac{-4x^3-x^2-9x+4}{(x+1)^2(x-3)}$ iv. $\frac{2(x^2+3x+3)}{(x+1)(x+2)(x+3)}$

v. $2x+6$ vi. $\frac{x+3}{x+9}$

vii. $\frac{-(x+3)(4x+7)}{(x+1)^2(x+2)}$ viii. $\frac{-2x+7}{(x-2)(x-3)}$

ix. $\frac{x^2-5x-42}{(x^2-9)(x+4)(x+5)}$ x. $\frac{2(x^2+5)}{4x^2+x+2}$

## Exercise 5.3

1. i. $6x-5y$ ii. $3x+\frac{1}{x}$ iii. $2x^2y^2-\frac{3xy}{z^2}$

iv. $18-12x-4y$ v. $(x+\frac{1}{x}+1)$ vi. $3(2x-1)(x-3)$

vii. $(x-1)(x-3)$ viii. $(x+3)(x+5)(x+2)$

2. i. $x^2+x+1$ ii. $5x^2+4x+1$ iii. $2x^2+2x+4$

iv. $\left(\frac{x}{y}+7-\frac{y}{x}\right)$ v. $x-1+\frac{1}{x}$ vi. $x+\frac{y}{3}+3z$

vii. $x^2-4+\frac{1}{x^2}$ viii. $x^3-2+\frac{1}{x^3}$

3. 7 4. $-24x^2+9$ 5. $m=20$ 6. $p=56,\ q=49$ 7. $a$=12, $b$=9

## Review Exercise 5

1. i. True ii. False iii. True iv. False v. True

2. i. two ii. $p(x)\,q(x)$ iii. 1

iv. $(y+1)(y+2)(y+3)$ v. $y+\frac{1}{y}$

3. i. *d* ii. *d* iii. *b* iv. *c* v. *b* vi. *d*
vii. *c* viii. *b* ix. *b* x. *c*

## Exercise 6.1

1. i. $x=20$ ii. $x=-12$ iii. $x=30$ iv. $x=40$
v. $y=\frac{1}{15}$ vi. $y=\frac{11}{20}$ vii. $x=\frac{44}{17}$ viii. $x=105$
ix. $\frac{105}{13}$ x. $x=1$ xi. $x=-\frac{20}{7}$ xii. $x=12$
xiii. $x=-\frac{5}{4}$ xiv. $x=-4$ xv. $m=\frac{-11}{6}$

2. { 5 } 3. $x=7$ 4. Bilal = 18 years old
Ali = 12 years old

5. i. {1} ii. { 10 } iii. { 100 }
iv. {−12} v. { 143 } vi. { }
vii. { 2 } viii. {81} ix. {80}

## Exercise 6.2

**1.** i. $\left\{-\frac{7}{2}, \frac{5}{2}\right\}$ ii. $\{1\}$ iii. $\{-42, 42\}$ iv. $\left\{-\frac{25}{2}, \frac{23}{2}\right\}$

v. $\{3\}$ vi. $\left\{-\frac{78}{5}, \frac{76}{5}\right\}$ vii. $\left\{-\frac{23}{2}, \frac{17}{2}\right\}$ viii. $\{-10, 6\}$

ix. $\left\{\frac{-19}{14}, \frac{-13}{14}\right\}$ x. $\{-41, 44\}$ xi. $\{\ \}$ xii. $\{-4, 3\}$

## Exercise 6.3

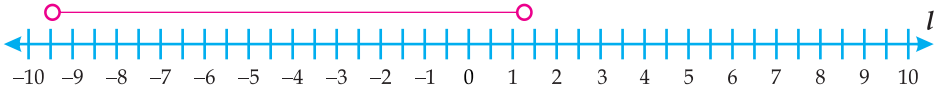
**1.** i. $\{14, 15, 16, \ldots\}$


ii. $\{x \mid x \in \mathbb{R} \wedge x > 4\}$

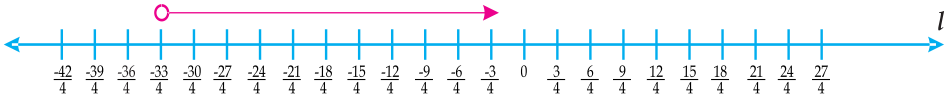

iii. $\{1, 2, 3, 4\}$


iv. $\{\ \}$


v. $\{y \mid y \in \mathbb{R}\ \frac{-19}{2} < y < \frac{3}{2}\}$




vi. $\{y \mid y \in \mathbb{R} \wedge y > -\frac{33}{4}\}$



2. All the numbers $\geq 4$

3. Ali must score at least 87 to quality for bonus prize.

## Review Exercise 6

1. i. False ii. False iii. True iv. True v. False

2. i. $\{0\}$ ii. $\{20\}$ iii. $\{\pm 4\}$
   iv. $\{-1\}$ v. $\{y \mid y \in \mathbb{R} \wedge -2 < y < 3\}$

3. i. *a* ii. *a* iii. *c* iv. *a* v. *b* vi. *c*
   vii. *c* viii. *c* ix. *c* x. *a*

## Exercise 7.1

1. i. Abscissa = –2, ordinate = 2 ii. Abscissa = 5, ordinate = –1
   iii. Abscissa = 4, ordinate = 0 iv. Abscissa = –5, ordinate = –6
   v. Abscissa = 3, ordinate = 4 vi. Abscissa = $-\sqrt{8}$, ordinate = $\sqrt{8}$

2. i. Lies in quadrant _ IV ii. Lies in quadrant _ II
   iii. Lies in quadrant - IV iv. Lies in quadrant – III
   v. Lies in quadrant - I vi. Lies in quadrant - I

3. i.