ANSWERS

(Answers to questions involving some calculations only are given.)

Exercise 1.1

1. Yes **2.** Yes **3.** No **4.** No **5.** Yes **6.** No **7.** Yes **8.** Yes

Exercise 1.2

2. $2 + 2 \neq 5$ **2.** Area of a square is not given by the formula $A = \pi r^2$

3. A cube is not a plane figure or it is not true that a cube is a plane figure

4. Georg Cantor did not develop set theory

5. Amitabh Bachchan is not the brand ambassador of Gujarat tourism.

6. $2 + 2 \neq 2^2$ **7.** For natural numbers $x \geq 3$, $x + x \neq x^2$ **8.** Ice is not hot.

Exercise 1.3

1. (1) p : $3 + 7 = 5$
q : $5^2 = 25$
$p \wedge q$: F

(2) p : $3 + 7 = 10$
q : $10^2 = 100$
$p \wedge q$: T

(3) p : A triangle has three sides.
q : A triangle has three angles.
$p \wedge q$: T

(4) p : A quadrilateral has four sides.
q : A quadrilateral has four angles.
$p \wedge q$: T

(5) p : The sum of the measures of angles of a triangle is 180.
q : The sum of the measures of angles of a triangle is 360.
$p \vee q$: T

(6) p : $2 + 2 = 5$
q : $5 + 2 = 25$
$p \wedge q$: F

(7) p : 1 is a root of $x^2 - 3x + 2 = 0$.
q : 2 is a root of $x^2 - 3x + 2 = 0$.
$p \wedge q$: T

(8) p : $1^3 = 1$
q : $3^2 = 9$
$p \vee q$: T

(9) p : $x^2 = x$ is satisfied by 1.
q : $x^2 = x$ is satisfied by 0.
$p \wedge q$: T

(10) p : 0 is the identity for addition.
q : 1 is the identity for multiplication.
$p \wedge q$: T

2. (1) $3 + 7 \neq 5$ or $5^2 \neq 25$ (2) $3 + 7 \neq 10$ or $10^2 \neq 100$

(3) A triangle does not have three sides or does not have three angles.

(4) A quadrilateral does not have four sides or it does not have four angles.
(5) The sum of the measures of angles of a triangle is not 180 and
The sum of the measures of angles of a triangle is not 360.
(6) $2 + 2 \neq 5$ or $5 + 2 \neq 25$ (7) 1 or 2 is not a root of $x^2 - 3x + 2 = 0$.
(8) $1^3 \neq 1$ and $3^2 \neq 9$ (9) $x^2 = x$ is not satisfied by 1 or 0.
(10) 0 is not the identity for addition or 1 is not the identity for multiplication.

3. (1) inclusive (2) exclusive (3) exclusive (4) inclusive (5) exclusive

5. p : 30 is divisible by 2.
q : 30 is divisible by 3. $p \wedge q \wedge r$: T
r : 30 is divisible by 5.
Negation : 30 is not divisible by 2 or by 3 or by 5.

6. p : 1 is a prime.
q : 1 is composite. $p \vee q$: F
Negation : 1 is not a prime and 1 is not composite.

Exercise 1.4

1. (1) Universal quantifier :
Negation : There exists a pair of natural numbers a and b such that $a + b$ is not even integer.
(2) Universal quantifier :
Negation : There exists an income tax payer who does not have a PAN card.
(3) Existential quantifier :
Negation : For all positive integers x, $\sqrt{x} \notin R$
(4) Existential quantifier :
Negation : For every element x, $x \notin \emptyset$
(5) Universal quantifier :
Negation : There exists some $\theta \in R$ such that $sin^2\theta + cos^2\theta \neq 1$
(6) Universal quantifier :
Negation : There exists an angle which can not be constructed by using a straight edge and compass only.
(7) Universal quantifier :
Negation : There exists a person of age exceeding 18 years who is not a voter.
(8) Existential quantifier :
Negation : There exists a subset of N which does not have a smallest element.
(9) Universal quantifier :
Negation : There exists a number ending in zero which is not divisible by 10.
(10) Existential quantifier :
Negation : Every multiple of 5 ends in 5.

2. (1) p : n is odd. q : n^2 is odd. , T

(2) p : 2 divides n. q : 4 divides n. , F

(3) p : 9 divides n. q : 3 divides n. , T

(4) p : All the angles of a quadrilateral have measure 90. q : It is a rectangle. , T

(5) p : All the angles of a triangle have same measure. q : It is equilateral. , T

(6) p : A triangle is isosceles. q : It is equilateral. , F

(7) p : A triangle is a right angle triangle. q : The largest side occurs opposite to the right angle.' T

(8) p : A triangle has sides $2uv$, $u^2 - v^2$, $u^2 + v^2$ for $u, v \in Z$ $(u > v)$. q : It is a right angle triangle. , T

(9) p : A triangle has sides $2mn$, $m^2 - n^2$, $m^2 + n^2$ for all $m, n \in N$ $(m > n)$. q : It is a right angle triangle. , T

(10) p : A number is divisible by 1001. q : It is divisible by 7, 11 and 13. , T

3. (1) Quadrilateral ABCD is a rectangle if and only if it is a square. F

(2) ΔABC is isoscles if and only if it is equilateral. F

(3) Quadrilateral ABCD has all angles and all the sides congruent if and only if it is a square. T

(4) Integer n is positive if and only if it is even. F

(5) A real number x is positive if and only if it is a square of another real number. T

Exercise 1.5

1. (1) Converse : If 2 divides n, 30 divides n.
Contrapositive : If 2 does not divide n, 30 does not divide n.

(2) Converse : If 16 divides n, 8 divides n.
Contrapositive : If 16 does not divide n, 8 does not divide n.

(3) Converse : If Sanjay will fail, he does not take the examination.
Contrapositive : If Sanjay will not fail, he takes the examination.

(4) Converse : If the square root of an integer is an integer, it is the square of an integer.
Contrapositive : If square root of an integer is not an integer, it is not the square of an integer.

(5) Converse : If n has three real cube roots, it is the cube of an integer.
Contrapositive : If n does not have three real cube roots, it is not the cube of an integer.

(6) Converse : If two lines in a plane are not parallel, they intersect.
Contrapositive : If two lines in a plane are parallel, they do not intersect.

(7) Converse : If the two sides opposite to two angles of a triangle are not congruent, then the angles opposite to them are not congruent.
Contrapositive : If the two sides opposite to two angles of a triangle are congruent, then the angles opposite to them are congruent.

(8) Converse : If in a plane $l \parallel n$ or $l = n$, then $l \parallel m$ and $m \parallel n$.
Contrapositive : If in a plane $l \nparallel n$ and $l \neq n$, then $l \nparallel m$ or $m \nparallel n$.

(9) Converse : If $a = \pm b$, then $a^2 = b^2$. $(a, b \in \mathrm{R})$
Contrapositive : if $a \neq \pm b$, then $a^2 \neq b^2$.

(10) Converse : If $a = b$, then $a^3 = b^3$. $(a, b \in \mathrm{R})$
Contrapositive : If $a \neq b$, then $a^3 \neq b^3$.

Exercise 1

1. (1) Yes (2) Yes (3) No (4) No (5) Yes (6) Yes (7) No (8) No (9) Yes (10) Yes

2. (1) Science and mathematics are not useful for development.
(2) One can not opt for engineering or medicine course.
(3) n is a perfect square and last digit of n is 3.
(4) There exists a prime number which is not odd.
(5) There is an odd number which is not prime.
(6) There exists an integer which is not a rational number.
(7) For all even integers n, n is not a prime.
(8) For all real numbers x, $x^2 \neq -1$
(9) There exists $a \in \mathrm{R}$ such that $a + 0 \neq a$.
(10) For every $a \in \mathrm{R}$, $a \cdot 1 = a$.
(11) There exists a real number x such that $x^2 = x$.
(12) For all $x \in \mathrm{R}$, $x^3 \not< x$.

4. (1) Converse : If you have an umbrella, it is raining outside.
Contrapositive : If you do not have an umbrella, it is not raining outside.

(2) Converse : If an integer has at least three factors, it is composite.
Contrapositive : If an integer does not have at least three factors, it is not composite.

(3) Converse : If $n = 1$, n is not a prime or not composite.
Contrapositive : If $n \neq 1$, n is a prime and composite.

(4) Converse : If opposite sides of a quadrilateral are congruent, the quadrilateral is a parallelogram.
Contrapositive : If opposite sides of a quadrilateral are not congruent, the quadrilateral is not a parallelogram.

(5) Converse : If a quadrilateral is a parallelogram, its diagonals are bisecting each other.
Contrapositive : If a quadrilateral is not parallellogram, its diagonals are not bisecting each other.

(6) Converse : If I will go to watch a new movie, it is Friday.
Contrapositive : If I will not go to watch a new movie, it is not Friday.

(7) Converse : If x^2 is positive, x is negative.
Contrapositive : If x^2 is not positive, x is not negative.

(8) Converse : If xy is positive, x and y are negative.
Contrapositive : If xy is not positive, x or y is not negative.

(9) Converse : If a quadrilateral is a square, it is equiangular.
Contrapositive : If a quadrilateral is not a square, it is not equiangular.

(10) Converse : If $p(a) = 0$, $x - a$ is a factor of polynomial $p(x)$.
Contrapositive : If $p(a) \neq 0$, $x - a$ is not a factor of polynomial $p(x)$.

10. (1) b (2) c (3) a (4) b (5) c (6) b (7) a (8) c (9) a (10) b
(11) a (12) a (13) b (14) c (15) d (16) b (17) b

Exercise 2.1

1. (1) {1, 2, 3,..., 9} (2) {6} (3) {−1, 6} (4) {−1, 0, 1}
(5) {−3, −2, −1, 0, 1, 2, 3}

2. $\emptyset$, {1}, {a}, {b}, {1, a}, {1, b}, {a, b}, A

3. (1) X = {a}, X = {c}, X = {a, b}, X = {a, c}, X = {b, c}, X = {a, b, c}
(2) X = {a}, X = {c}, X = {a, b}, X = {a, c}, X = {b, c}
(3) {a, b}, {c, d}, {a, b, d}, {a, c, d}, {b, c, d}, A

4. (1), (2), (3)

Exercise 2.2

1. A $\cup$ B = {1, 2, 3, 4, 5, 7, 11, 13}, A $\cap$ B = {2, 3}

4. (1) {a, b, c, d, e, f} (2) {c, d, e} (3) {a, b} (4) {f} (5) {a, b, f}

Exercise 2.3

1. $A \times B = \{(1, 4), (1, 7), (2, 4), (2, 7), (3, 4), (3, 7)\}$
$B \times A = \{(4, 1), (4, 2), (4, 3), (7, 1), (7, 2), (7, 3)\}$

3. $\{(1, 2), (1, 5), (1, 8), (1, 11), (2, 2), (2, 5), (2, 8), (2, 11),$
$(3, 2), (3, 5), (3, 8), (3, 11), (4, 2), (4, 5), (4, 8), (4, 11)\}$

Exercise 2.4

1. 125 **2.** Incorrect data **3.** 11, 6 **4.** 43 **5.** 60

Exercise 2

1. (1) $A = \{2, 3, 5, 7, 11, 13, 17, 19\}$ (2) $\beta = \{A, E, I, O, U\}$
(3) $X = \{6, 7, 8, 9, 10\}$ (4) $X = \{-1, 1\}$ (5) $\emptyset$

2. (1) $A = \{x \mid x \in N, x$ is multiple of 5, less than 25.$\}$
(2) $P = \{x \mid x$ is an odd natural number.$\}$

3. (1) $A - B = \{1, 5, 9\}$ (2) $B - A = \{11\}$
(3) $A \cup B = \{1, 3, 5, 7, 9, 11\}$

6. $\emptyset$, $\{1\}$, $\{5\}$, $\{9\}$, $\{1, 5\}$, $\{1, 9\}$, $\{5, 9\}$, A **9.** 40 **10.** 5

11. (1) c (2) b (3) a (4) c (5) a (6) b (7) c (8) c (9) b (10) b
(11) c (12) a (13) d (14) b (15) c (16) b (17) b (18) a (19) c (20) a
(21) a (22) b (23) c (24) c (25) d (26) b (27) a (28) c (29) c (30) b
(31) c

Exercise 3.1

1. Domain = $\{1, 2, 3, 4, 5, 6, 7\}$, Range = $\{1, 2, 3, 4, 5, 6, 7\}$

2. $S = \{(2, 8), (3, 27), (5, 125), (7, 343)\}$

3. $S = \{(1, 4), (1, 6), (2, 9), (3, 4), (3, 6), (5, 4), (5, 6)\}$

4. $S = \{(5, 3), (6, 4), (7, 5)\}$

Exercise 3.2

1. (1) $\{3, 4, 5, 6, ...\}$ (2) $\{2, 4, 8, 16, 32, ...\}$ (3) $\{5\}$ (4) Z

3. $f(4) = 27$, $f(16) = 275$ **4.** $a = 3$

Exercise 3.3

2. (1) $R_f = \left\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \ldots\right\}$ (2) $R_h = \{0\}$

Exercise 3

1. $fog = \{(4, 4), (5, 5), (6, 6)\}$, $gof = \{(1, 1), (2, 2), (3, 3)\}$

2. (1) $fog(x) = 2x + 1$ $gof(x) = 2x + 2$
$fof(x) = x + 2$ $gog(x) = 4x$

(2) $fog(x) = 9x^2 + 2$ $\quad gof(x) = 3x^2 + 6$

$fof(x) = x^4 + 4x^2 + 6$ $\quad gog(x) = 9x$

(3) $fog(x) = 4x^2 - 6x + 1$ $\quad gof(x) = 2x^2 + 6x - 1$

$fof(x) = x^4 + 6x^3 + 14x^2 + 15x + 5$ $\quad gog(x) = 4x - 9$

(4) $fog(x) = x$ $\quad gof(x) = x$

$fof(x) = x + 2$ $\quad gog(x) = x - 2$

(5) $fog(x) = 18x^2 + 1$ $\quad gof(x) = 6x^2 + 3$

$fof(x) = 8x^4 + 8x^2 + 3$ $\quad gog(x) = 9x$

3. Domain = {1, 2, 3, 4}, Range = {1, 2, 3, 4} **4.** S = {(1, 1), (2, 4), (3, 9), (4, 16)}

6. (1) R (2) $[0, \infty)$ (3) R (4) {1000} (5) $[0, \infty)$

8. $f(9) = 6$, $f(2) = 2 - \sqrt{2}$

9. (1) $fog(x) = (x - 1)^2$ $\quad gof(x) = x^2 - 1$

$fof(x) = x^4$ $\quad gog(x) = x - 2$

(2) $fog(x) = 5x - 5$ $\quad gof(x) = 5x - 25$

$fof(x) = x - 10$ $\quad gog(x) = 25x$

(3) $fog(x) = x^4 + 6x^2 + 6$ $\quad gof(x) = x^4 - 6x^2 + 12$

$fof(x) = x^4 - 6x^2 + 6$ $\quad gog(x) = x^4 + 6x^2 + 12$

10. $fog(x) = x$ $\quad gof(x) = |x|$

$fof(x) = x^4$ $\quad gog(x) = \sqrt[4]{x}$

12. (1) b (2) b (3) c (4) c (5) b (6) b (7) c (8) a (9) a (10) c (11) d

Exercise 4.1

1. (1) $\left\{\frac{k\pi - 1}{2} \mid k \in Z\right\}$ (2) $\left\{(2k + 1)\frac{\pi}{6} - \frac{2}{3} \mid k \in Z\right\}$ (3) $\left\{(4k - 1)\frac{\pi}{2} \mid k \in Z\right\}$

(4) $\{2k\pi \mid k \in Z\}$ (5) $\left\{(2k + 1)\frac{\pi}{6} \mid k \in Z\right\}$ (6) $\emptyset$

2. (1) $[-2, 8]$ (2) $\{p \mid p \leq 2, p \in R\}$ (3) $[-4, -1]$ (4) $[0, 3]$

(5) $\{p \mid p \geq 0, p \in R\}$ (6) $R - (-5, 1)$

4. $\frac{2x(x+1)}{2x^2+2x+1}$ **5.** 65 **6.** $\frac{5}{13}$

Exercise 4.2

1. (1) $\frac{4\pi}{3}$ (2) $\frac{5\pi}{12}$ (3) $\frac{121\pi}{540}$ (4) $\frac{221\pi}{360}$

2. (1) 12° (2) 458° 10' 54" (3) 5° 37' 30" (4) 14° 19' 5" **3.** 19° 5' 27"

4. 10π **5.** 16° 2' 11" **6.** 22 : 13 **7.** 105°, $\frac{7\pi}{12}$ **8.** $\frac{\pi}{4}$ **9.** $\frac{3}{4}$

Exercise 4.3

1. $\sin\theta = \frac{3}{5}$, $\cos\theta = \frac{-4}{5}$, $\tan\theta = \frac{-3}{4}$, $\sec\theta = \frac{-5}{4}$, $\cot\theta = \frac{-4}{3}$

2. $\cos\theta = \frac{-1}{5}$, $\tan\theta = 2\sqrt{6}$, $\operatorname{cosec}\theta = \frac{-5}{2\sqrt{6}}$, $\cot\theta = \frac{1}{2\sqrt{6}}$, $\sec\theta = -5$

3. 7 **4.** $\frac{-1}{2}$ **5.** $\sec\theta = \frac{p^2+1}{2p}$, $\tan\theta = \frac{p^2-1}{2p}$, $\sin\theta = \frac{p^2-1}{p^2+1}$ **6.** $\frac{1}{2}$

Exercise 4

14. (1) c (2) d (3) c (4) c (5) b (6) c (7) b (8) b (9) b (10) a
(11) a (12) d (13) a (14) a (15) b (16) b (17) b (18) d (19) b (20) b
(21) d

Exercise 5.1

1. $\frac{7}{2}$ **2.** 6 **3.** 6 **5.** $\frac{1+3\sqrt{3}}{8}$ **6.** $\frac{90-53\sqrt{3}}{6}$

Exercise 5.3

1. (1) $n = 2$, $\alpha = 30^\circ$ (2) $n = 3$, $\alpha = 45^\circ$ (3) $n = 4$, $\alpha = 45^\circ$

2. (1) $n = 2$, $\alpha = 120^\circ$ (2) $n = 2$, $\alpha = -45^\circ$ (3) $n = 4$, $\alpha = -30^\circ$

Exercise 5

4. (1) $n = 3$, $\alpha = -240^\circ$ (2) $n = 5$, $\alpha = -200^\circ$ (3) $n = 1$, $\alpha = -180^\circ$

5. (1) a (2) a (3) b (4) a (5) a (6) a (7) b (8) d (9) a (10) b

Exercise 6.1

1. $\left(\frac{13}{5}, \frac{-9}{5}\right)$ **2.** (2, 15) **3.** $\lambda = 8{:}5$ **4.** (3, 4), (5, 6) **5.** $\left(\frac{27}{2}, \frac{9}{2}\right)$, $\left(\frac{-3}{2}, \frac{3}{2}\right)$

6. $\frac{-9}{10}$

Exercise 6.2

1. (7, 0) **2.** Maximum : 27, Minimum : 15 **3.** 6

4. $\overleftrightarrow{AB} = \left\{(x, y) \middle| \begin{matrix} x = -13t + 3 \\ y = -2t + 2 \end{matrix} ; t \in R\right\}$; $\overrightarrow{AB} = \left\{(x, y) \middle| \begin{matrix} x = -13t + 3 \\ y = -2t + 2 \end{matrix} ; t \geq 0\right\}$

$\overline{AB} = \left\{(x, y) \middle| \begin{matrix} x = -13t + 3 \\ y = -2t + 2 \end{matrix} ; t \in [0,1]\right\}$;

$\overleftrightarrow{AB} = \left\{(x, y) \middle| \begin{matrix} x = -13t + 3 \\ y = -2t + 2 \end{matrix} ; t \in R - [0,1]\right\}$

6. $4x + 3y + 1 = 0$

Exercise 6.3

1. $\frac{-1}{2}$, 2 **2.** $\frac{-5}{6}$, $\frac{-3}{5}$, -2 **3.** $\frac{2}{3}$, 14 **5.** $\frac{\pi}{4}$ **9.** $\frac{-2}{7}$ **11.** $\frac{3}{2}$

13. 1, 2 or $\frac{1}{2}$, 1 or -1, -2 or $\frac{-1}{2}$, -1

Exercise 6.4

1. $x - 5y + 27 = 0$ **2.** $x + y - 4 = 0$ **3.** $x - y + 1 = 0$, $x + y - 3 = 0$

5. $15x - 10y + 12 = 0$ **7.** $x + \sqrt{3}y - 3 = 0$ **8.** $\sqrt{3}x + y - 4 = 0$

9. $(2 + \sqrt{3})x - y - \sqrt{3} = 0$, $(2 - \sqrt{3})x - y + \sqrt{3} = 0$

10. $x + y - 4 = 0$, $x + 9y = 12$

11. $(\sqrt{3} + 1)x + (\sqrt{3} - 1)y = 4$, $(\sqrt{3} - 1)x - (\sqrt{3} + 1)y = 4$

12. $7x - 4y - 3 = 0$, $7x - 4y + 25 = 0$, $4x + 7y - 11 = 0$

13. $7x + y - 9 = 0$, $x - 7y + 13 = 0$

Exercise 6

3. $3x \pm 4y = 36$, $-3x \pm 4y = 36$ or $4x \pm 3y = 36$, $-4x \pm 3y = 36$ **6.** (0, 5), $\left(0, \frac{-15}{2}\right)$

7. $x - y + 1 = 0$, $x - 7y + 19 = 0$ **8.** (1, -2), (-1, 3)

9. $x + y = 5$, $3x = 2y$ **10.** $x + 2y = 6$ **12.** $3x + 4y = 12$, $4x + 3y = 12$

13. (8, 0), (-2, 0) **14.** $x = -1$ **15.** $x + 2y = 5$ **16.** $2x - y + 3 = 0$

17. $8x - 3y = 0$, $23x + 23y - 11 = 0$, $23x - 23y + 5 = 0$

18. (1) d (2) a (3) d (4) b (5) d (6) b (7) d (8) a (9) b (10) d (11) b

Exercise 7.1

1. 320 **2.** 2240 **3.** 120, 24, 24 **4.** 136 **5.** 2339766 **6.** 90, 90, 225, 225

7. 1204533

Exercise 7.2

1. (1) 1680 (2) 504 (3) 720 **2.** (1) 720 (2) 20160 (3) 72

4. (1) $r = 13$ (2) $r = 6$ **5.** $n = 6$ **6.** $r = 41$ **8.** $n = 3$ **9.** $n = 5$

10. 64, 24 **11.** 2^n **12.** 4^{10} **13.** 16 **14.** 67600, 58500 **15.** 729

16. $m!\ {}_{m+1}P_n$ **17.** (i) $2(n-1)!$, $n! - 2(n-1)!$ **18.** 96 **19.** 8 **20.** 2880, 1152

21. 518400 **22.** 30, 360 **23.** 24, 20th **24.** 108 **25.** 24, 24, 24 **26.** 12

Exercise 7.3

1. 3rd **2.** NIGAA, 60th **3.** 127 **4.** 5274 **5.** 133320 **6.** 1440

7. 36 **8.** 1440 **9.** 12, 0 **10.** 144 **11.** 24, 108th **12.** 1260

13. 1663200 **14.** $x = 6$

Exercise 7.4

1. (1) 28 (2) 10 (3) 210 **2.** $n = 14$ **3.** (i) $r = 7$, (ii) $r = 8$
4. $n = 8$, $r = 4$ **5.** $n = 12$, $r = 4$ **7.** $r = 6$ or 8

Exercise 7.5

1. 80, 31 **2.** (1) 1050 (2) 2534 (3) 420 (4) 469 **3.** (1) 28561 (2) 495 (3) 29900
4. 64 **5.** 756756 **6.** 14968800 **7.** $n! - 2(n-1)!$ **8.** $\frac{n(n-3)}{2}$
9. $n = 11$ **10.** (i) $\binom{n}{3}$ (ii) $n(n-4)$ (iii) n (iv) $\frac{n(n-4)(n-5)}{6}$

Exercise 7

1. (1) 1230 (2) 1 (3) 321 (4) 321 **2.** 168 **3.** 12 **4.** (i) 15 (ii) 120
5. $\binom{n}{r} - \binom{n-2}{r-2}$ **6.** 85 **7.** 1023 **8.** $\frac{mn}{2}(m+n-2)$
9. (1) d (2) a (3) a (4) c (5) d (6) b (7) a (8) c (9) d (10) b
(11) b (12) c (13) d (14) c (15) a (16) c (17) a (18) d (19) d (20) a
(21) d (22) c (23) a (24) d (25) b

Exercise 8.1

1. (1) $\emptyset$ (2) $\{..., -12, -11\}$ (3) $(-\infty, -10)$
2. (1) $\{4, 5, 6, ...\}$ (2) $\{4, 5, 6, ...\}$ (3) $[4, \infty)$
3. (1) $\{4, 5, 6, ...\}$ (2) $\{4, 5, 6, ...\}$ (3) $[4, \infty)$
4. (1) N (2) $\{-3, -2, -1, 0, 1, 2, ...\}$ (3) $[-3, \infty)$
5. $(5, \infty)$ **6.** $(-\infty, 9)$ **7.** $[9, \infty)$ **8.** $(-\infty, 4]$ **9.** $\left(-\infty, \frac{-23}{11}\right)$
10. $(-\infty, -2)$ **11.** (1) $(-\infty, 3) \cup (7, \infty)$ (2) $\left(-\infty, \frac{2}{3}\right) \cup \left(\frac{7}{2}, \infty\right)$
12. (1) $(-\infty, 0) \cup (3, \infty)$ (2) $(-\infty, 2) \cup \left[\frac{11}{5}, \infty\right)$ (3) $\left(\frac{-17}{2}, -5\right)$ **13.** $\left(\frac{-1}{2}, 0\right)$
14. R **15.** R

Exercise 8.2

1. $(-\infty, -1)$ **2.** $(1, \infty)$ **3.** $(-\infty, -12]$ **4.** $(-\infty, -10.8]$ **5.** $(-\infty, -61]$
6. $\left[\frac{-43}{37}, \infty\right)$ **7.** $\left(-\infty, \frac{67}{65}\right)$ **8.** $\left(-\infty, \frac{8}{11}\right]$ **9.** $(0, 2)$
10. $(1, \infty)$ **11.** $(-\infty, 0)$ **12.** $(-\infty, 0)$

Exercise 8.3

1. $[3, 5]$ **2.** $(3, 8)$ **3.** $[4, 6)$ **4.** $(4, 6]$ **5.** $\emptyset$ **6.** $(-\infty, -2]$ **7.** $[2, 5]$
8. $\emptyset$ **9.** $(-\infty, -3)$ **10.** $(-1, 8)$

Exercise 8

1. $R - [-1, 1]$ **2.** $(2, 4]$ **3.** $[R - (-8, 8)] \cup (-5, 5)$ **4.** $[-2, 2]$ **5.** $\emptyset$

6. $\{x \in R \mid 7.95 < x < 8.85\}$ **7.** (1) $x = 1000$ (2) $x > 1000$

8. 31 and 33; 33 and 35; 35 and 37

9. (1) $(-\infty, 5)$ (2) $R - \{0\}$ (3) $(2, \infty)$ (4) $[3, \infty)$ (5) $\left(\frac{-1}{2}, \frac{1}{8}\right) - \{0\}$

(6) $\{..., -4, -3, -2\} \cup \{4, 5, 6,...\}$ (7) $[3, \infty)$ (8) $(-\infty, 0) - \{-1\}$

10. (1) $R - [1, 3]$ (2) 0 (3) $x < 4$ (4) $5 > x > -1$ (5) $\emptyset$

11. (1) $x + y \leq 1, x - y \leq 1$ (2) $x < 5, y < 1, 2x + y \geq 4$

12. (1) d (2) b (3) b (4) c (5) d (6) b (7) b (8) a (9) c (10) c
(11) d (12) a (13) d (14) c (15) a

Exercise 9.1

1. 5.6 **2.** 40 **3.** 5.27 **4.** 7 **5.** 14.52 **6.** 16 **7.** 4.97 **8.** 5.1

9. 8.6 **10.** 16.44, 16.44 **11.** 11.33 **12.** 157.92 **13.** 10.16 **14.** 7.35

Exercise 9.2

1. (i) 3.041 (ii) 10.61 (iii) 3.428 **2.** (i) 2.007 (ii) 6.58

3. (i) $\bar{x} = 9, s = 3.88$ (ii) $\bar{x} = 14, s = 6.7$ **4.** $\bar{x} = 64, s = 1.691$

5. $\bar{x} = 27, s^2 = 132.02, s = 11.49$ **6.** (i) $\bar{x} = 62, s = 14.18$ (ii) $\bar{x} = 93, s = 10.27$
(iii) $\bar{x} = 21.5, s = 12.84$ **7.** 1351.88 **8.** 4.22

Exercise 9.3

1. 0.1062 **2.** Performance of A is better. **3.** Heights show more variability.

4. Yes **5.** Share B has more variation in its price. **6.** Weights show more variability.

7. Chemistry shows highest variability and mathematics shows lowest variability.

8. Group G_2 has more variation.

Exercise 9

1. 4, 9 **2.** 4, 8 **4.** 24, 12 **5.** $\bar{x} = 40.045, s = 14.995$

6. (1) d (2) c (3) a (4) b (5) c (6) b (7) b (8) c (9) a (10) c
(11) a (12) d (13) c (14) c (15) a (16) a

Exercise 10.1

1. $U = \{HR_1, HR_2, HR_3, HG_1, HG_2, HG_3, HG_4, T1, T2, T3, T4, T5, T6\}$

2. $U = \{R_1R_2, R_1W_1, R_1W_2, R_1W_3, R_2W_1, R_2W_2, R_2W_3, W_1W_2, W_1W_3, W_2W_3\}$

3. (1) U = {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}

(2) U = {H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6}

4. U = {HH, HT, T1, T2, T3, T4, T5, T6}

5. U = {1H, 1T, 3H, 3T, 5H, 5T, 2HH, 2HT, 2TH, 2TT, 4HH, 4HT, 4TH, 4TT, 6HH, 6HT, 6TH, 6TT}

6. U = {R_1R_1, R_1R_2, R_1R_3, R_1W_1, R_1W_2, R_1B
R_2R_1, R_2R_2, R_2R_3, R_2W_1, R_2W_2, R_2B
R_3R_1, R_3R_2, R_3R_3, R_3W_1, R_3W_2, R_3B
W_1R_1, W_1R_2, W_1R_3, W_1W_1, W_1W_2, W_1B
W_2R_1, W_2R_2, W_2R_3, W_2W_1, W_2W_2, W_2B
BR_1, BR_2, BR_3, BW_1, BW_2, BB}

7. U = {AB, AC, AD, BC, BD, CD}

8. U = {(−, *abc*), (*abc*, −), (*ab*, *c*), (*ac*, *b*), (*bc*, *a*), (*a*, *bc*), (*b*, *ac*), (*c*, *ab*)}

9. U = {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT1, TTT2, TTT3, TTT4, TTT5, TTT6}

10. U = $\left\{(x, y) \mid \begin{matrix} x = a, b, c, d, e, f \\ y = 1, 2, 3, 4, 5, 6 \end{matrix}\right\}$

Exercise 10.2

1. U = {RR, RB, RY, RW, BR, BB, BY, BW, YR, YB, YY, YW, WR, WB, WY, WW}
A = {RR, BB, YY, WW}
B = {RW, BW, YW, WR, WB, WY}
C = {RW, BW, YW, WR, WB, WY, WW}
D = {RB, RY, RW, BR, BY, BW, YR, YB, YW, WR, WB, WY}
$A \cap B = \emptyset$, $B \cup C = C$, $A \cup D = U$, $A \cap D = \emptyset$, $B \subset C$
A and D are mutually exclusive events.

2. A = {HHH, HHT, HTH, THH}
B = {TTH, THT, TTH}
C = {HHH, HHT, HTH, HTT}
D = {THH, HTH, HHT, HTT, THT, TTH, TTT}
$A \cap B = \emptyset$, $C \cap D' = \{HHH\}$
$A \cup C = A = C$, $B \cap C = \emptyset$, $A' \cup C' = \{HTT, THT, TTH, TTT\}$

3. $A_2 = \{2, 4, 6, \ldots, 30\}$, $A_3 = \{3, 6, 9, \ldots, 30\}$,
$A_4 = \{4, 8, 12, 16, \ldots, 28\}$, $A_5 = \{5, 10, 15, \ldots, 30\}$
(1) F (2) T (3) T

4. U = $\{W_1W_2, W_1R, W_1G_1, W_1G_2, W_2R, W_2G_1, W_2G_2, G_1G_2, RG_1, RG_2\}$

A = $\{W_1W_2\}$

B = $\{W_1W_2, W_1R, W_1G_1, W_1G_2, W_2R, W_2G_1, W_2G_2\}$

C = $\{W_1R, W_1G_1, W_1G_2, W_2G_1, W_2G_2, W_2R, RG_1, RG_2\}$

5. A = {2, 4, 6,..., 50}, B = {10, 20, 30, 40, 50}, C = {4, 8, 12,..., 48}

6. $U = \left\{(x, y) \mid \begin{matrix} x = 1, 2, 3, 4, 5, 6 \\ y = 1, 2, 3, 4, 5, 6 \end{matrix}\right\}$

A = {(1, 3), (2, 2), (2, 6), (3, 1), (3, 5), (4, 4), (5, 3), (6, 2), (6, 6)}

B = {(1, 2), (1, 5), (2, 1), (2, 4), (3, 3), (3, 6), (4, 2), (4, 5), (5, 1), (5, 4), (6, 3), (6, 6)}

C = {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (2, 1), (2, 2), (2, 3), (2, 4), (3, 1), (3, 2), (3, 3), (4, 1), (4, 2), (5, 1)}

D = {(2, 2), (2, 4), (2, 6), (4, 2), (4, 4), (4, 6), (6, 2), (6, 4), (6, 6)}

7. U = {*aa, ab, ac, ba, bb, bc, ca, cb, cc*} A = {*ab, ac, ba, ca*}

B = {*aa, bb, cc*} C = {*ac, bc, ca, cb, cc*}

8. U = $\{B_1B_2, B_1B_3, B_1G_1, B_1G_2, B_2B_3, B_2G_1, B_2G_2, B_3G_1, B_3G_2, G_1G_2\}$

E = $\{G_1G_2\}$

F = $\{B_1G_1, B_1G_2, B_2G_1, B_2G_2, B_3G_1, B_3G_2\}$

G = $\{B_1B_2, B_1B_3, B_2B_3, B_1G_1, B_1G_2, B_2G_1, B_2G_2, B_3G_1, B_3G_2\}$

9. A = {1, 2, 3, 4, 5, 6}, B = {3, 6}, C {5, 6}, D = {1}

$A \cap C = \{5, 6\}$, $B \cup C = \{3, 5, 6\}$, $D' \cup C' = \{1, 2, 3, 4, 5, 6\}$

Exercise 10

1. (1) 0.24 (2) 0.11 (3) 0.30 (4) 0.35

2. (1) $\frac{1}{142506}$ (2) $\frac{53130}{142506}$ (3) $\frac{89376}{142506}$ **4.** (1) $\frac{7}{8}$ (2) $\frac{3}{8}$ (3) $\frac{1}{2}$

5. $P(A) = \frac{1}{6}$, $P(B) = \frac{1}{3}$, $P(C) = \frac{3}{4}$, $P(D) = \frac{1}{12}$

6. $\frac{8}{25}$ **7.** $\frac{7}{8}, \frac{7}{456}$ **8.** $\frac{\binom{12}{6}\binom{40}{7}}{\binom{52}{13}}$

9. (1) a (2) a (3) b (4) c (5) b (6) b (7) a (8) b (9) c (10) a (11) d (12) c

TERMINOLOGY (In Gujarati)

Antecedent	પૂર્વવિધાન
Arrow diagram	કિરણ આકૃતિ
Associative law	જૂથનો નિયમ
Average deviation	સરેરાશ વિચલન
Biconditional statement	દ્વિપ્રેરણ
Cartesian product	કાર્તેઝિય ગુણાકાર
Cartesian product of sets	ગણોનો કાર્તેઝિય ગુણાકાર
Ceiling function	ન્યૂનતમ પૂર્ણાંક વિધેય
Circular permutation	વર્તુળાકાર ગોઠવણી
Closed interval	સંવૃત્ત અંતરાલ
Closure	સંવૃત્તતા
Codomain	સહપ્રદેશ
Coefficient of variation	ચલનાંક
Combination	સંચય
Complementary event	પૂરક ઘટના
Complementation	પૂરકક્રિયા
Composition of functions	વિધેયોનું સંયોજન
Compound event	સંયુક્ત ઘટના
Compound statement	સંયુક્ત વિધાન
Commutative law	ક્રમનો નિયમ
Conjuction	સંયોજન
Consequent	ઉત્તર વિધાન
Constant function	અચળ વિધેય
Contrapositive	સમાનાર્થી પ્રેરણ
Converse	પ્રતીપ (શરતી વિધાન)
Coordinates of the point of division	વિભાજન બિંદુના યામ
Difference event	તફાવત ઘટના
Difference set	તફાવત ગણ
Disjoint sets	અલગગણ