Question bank

Chapter-1 Topic 1 Revision

Q-1 **Round off each number to the nearest 10 000.**

a) 6 237 714

b) 552 459

c) 846 010

Q-2 **Round off each number to the nearest 100.**

a) 46 762

b) 93 417

c) 50 094

Q-3 **Write each number correct to one d.p.**

a) 17.7108

b) 0.9575

c) 31.013

Q-4 **Write each number correct to three d.p.**

a) 0.28456

b) 17.0407

c) 1.2644

Q-5 **Write each number correct to two s.f.**

a) 52 913 900

b) 1.9523

c) 0.00284

Q-6 **Write each number correct to four s.f.**

a) 41 632 509

b) 71.20437

c) 0.18947

Q-7 **Write each of the following numbers in expanded form.**

a) 1.86×10^{3}

b) $3.047 \times 10\blacksquare^{2}$

c) $2.1982 \times 10\blacksquare$

d) 5.58 × 10■■

e) 1.296 × 10■

f) 8.404 × 10■■

g) 6.0339 × 10■

h) 9.515 × 10■■

Q-8 **Write each of the following numbers in standard form.**

a) 218.5

b) 0.523

c) 417 000

d) 0.008272

e) 84 040

f) 0.000093658

g) 6 217 400

h) 0.00000030011

Q-9 **Write this expression in index form: 3 × p × 2 × q × p × q × p.**

Q-10 **Use the laws of indices to simplify each of the following. Write your answers with positive indices, where necessary.**

a) x■ × x

b) z■ ÷ z■

c) (xy^2z^3)■

d) a■ × a■¹

e) $1^2 + 6$

f) $(p^2q$■$^3)^3$

g) $(r^2 \times r$■■$)$■¹

h) (x^2/y^3)■

i) x■² × x■■

j) $x^2 \div x^{11}$

k) a■ × a■■

l) (st)■■

m) (–3pqr)■³

n) (c■²/d³)■■

o) 81^(¼)

p) (125y■)^(⅔■)

Q-11 **Write each of the following in index form.**

a) ■p

b) ■y^3

c) √x■

d) ■4b

Q-12 **Write each of the following in root form.**

a) x^(■)

b) (6b)^(½)

c) y^(⅔■)

d) z^(■/■)

Q-13 **Write each of the following in logarithm form.**

a) 2■ = 32

b) 3■ = 2,187

c) 4■ = q

d) x■ = z

Q-14 **Write each of the following in index form.**

a) log 10 = 1

b) log■ 216 = 3

c) log■ 5 = k

d) log_c d = e

Q-15 **Simplify each of the following.**

a) log 2 + log 5

b) log■ 3 + log■ 9

c) log■ 4 + log■ 16

d) log■■ 288 – log■■ 2

e) log 500 – log 5 – log 10^3

f) log■ (1/9)

g) log■ 625

h) log■ m^3 + log■ k■ – log■ p

i) log 16 + 2 log 5 – 2 log 2

j) log■ 27 × log■ 25 × log■ 16

Q-16 **Use the logarithmic tables to find the logarithms of each of the following (correct to four d.p.).**

a) 5.945

b) 59.45

c) 1.189

d) 118.9

e) 4.374

f) 4 374

g) 7.491

h) 74 910

Q-17 **Use the logarithmic tables to find the antilogarithms of each of the following.**

a) 0.973

b) 1.973

c) 0.1658

d) 3.1658

e) 0.6612

f) 2.6612

g) 0.4202

h) 4.4202

Q-18 **Use the logarithmic tables to calculate each of the following (correct to four s.f.).**

a) 6.651 × 5.12

b) 99.44 ÷ 32.31

c) 33.39 × 12.95

d) 839.2 ÷ 101.2

e) 74.6 × 29.69

f) 62.3 ÷ 3.482

g) 630.7 × 2.226

h) 47.93 ÷ 8.724

Q-19 **Solve:**

a) Make P the subject of the formula $A = P(1 - r/100)$■

b) Make t the subject of the formula $SI = P \cdot r \cdot t/100$

c) Make h the subject of the formula $V = \frac{1}{2} \cdot b \cdot h \cdot H$

d) Make r the subject of the formula $x^2 + y^2 = r^2$

e) Make s the subject of the formula $V = s^3$

f) Make a the subject of the formula $T_n = a \cdot r^{n-1}$

g) Make r the subject of the formula $S_\infty = a/(1 - r)$

h) Make v the subject of the formula $1/u + 1/v = 1/f$

Q-20 **Solve:**

a) $5x + 4 = 3x + 8$

b) $3x/2 - 1 = 5$

c) $2(x + 6) - 1 = 3 - (7 - x)$

d) $10(2 - x) + 6x = 3(x - 5)$

e) $5(2x - 1) = 2(5x + 9)$

f) $(x - 9)/2 = (3x + 4)/4 + 1$

g) $2 + (x + 2)/2 = 7 + x/2 - 0.5$

h) $(3/x) + 7 - (5/2x) = (2x - 1)/x$

i) $(x + 6)/(x - 3) = (x - 8)/(x + 1)$

j) $(2x + 3)/(x - 4) = (2x - 1)/(x + 3)$

Q-21 **Solve each of the following quadratic equations by factorising**

a) $x^2 - 5x + 4 = 0$

b) $2x^2 - 24x + 54 = 0$

c) $6x^2 + 13x + 6 = 0$

d) $3x^2 - 23x - 8 = 0$

Q-22 **Solve each quadratic equation (correct to two d.p.) using the quadratic formula**

a) $x^2 + x - 10 = 0$

b) $x^2 + 7x + 2 = 0$

c) $2x^2 + 11x + 6 = 0$

d) $3x^2 - x - 9 = 0$

Q-23 **Solve each quadratic equation (correct to two d.p.) by completing the square**

a) $x^2 - 2x - 5 = 0$

b) $x^2 + 8x + 3 = 0$

c) $2x^2 - 9x - 4 = 0$

d) $6x^2 - 18x + 1 = 0$

Q-24 **Find the equation of each of the following quadratic functions.**

a)

b)

Q-25 **Draw the graph of each of the following on its own system of axes. Show all the intercepts with the axes, as well as the coordinates of the vertex. Use a dotted line to indicate the line of symmetry and give the equation of the line of symmetry.**

a) $y = -x^2 + 3x + 4$

b) $y = 3x^2 - 12x + 9$

Q-26 **Copy and complete the following truth tables.**

a)

b)

Q-27 **Given the statements P: 'It is Saturday' and Q: 'The market is busy', write down a simple sentence that describes each of the following logical statements.**

a) $\neg P$

b) $\neg Q$

c) $P \wedge Q$

d) $P \vee Q$

e) $\neg\neg Q$

f) $P \Rightarrow Q$

g) $Q \Leftrightarrow P$

h) $P \Rightarrow \neg Q$

Q-28 **Eya constructed a circle with a radius of 20 cm and then shaded a sector of the circle with an angle θ at the centre. Calculate each of the following, correct to two decimal places.**

a) the length of the arc of the sector, if $\theta = 60°$

b) the area of the sector, if $\theta = 205°$

c) the perimeter of the arc of the sector, if $\theta = 130°$

Q-29 **A sector of a circle is shown in the diagram. If the angle θ of the sector is chosen so that the length of the arc equals the radius r of the circle, calculate the size of θ, correct to the nearest tenth of a degree.**

Q-30 **Use the trigonometric tables or a calculator to calculate each of the following, correct to two decimal places.**

a) sin 29°

b) cos 78.3°

c) tan 42.7°

d) sin 65.6°

e) cos 38°

f) tan 85.8°

Q-31 **Use the trigonometric tables or a calculator to calculate the value of θ in each of the following, correct to one decimal place.**

a) $\sin \theta = 0.24$

b) $\cos \theta = 0.43$

c) $\tan \theta = 6$

d) $\sin \theta = 0.75$

e) $\cos \theta = 0.57$

f) $\tan \theta = 1.2$

Q-32 **In the diagram below, two points on the ground, A and B, are in line with the base of a water tower WT, such that B is exactly halfway between A and T. The angle of elevation from B to W is 36° and the height of the water tower is 15 m.**

a) Calculate the distance between A and the foot of the tower, correct to the nearest metre.

b) Calculate the angle of elevation from A to W, correct to the nearest degree.

Q-33 **Points P, Q and R form the vertices of an equilateral triangle, as shown. If the bearing of point Q from point P is 145°, calculate:**

a) the bearing of point R from point Q

b) the bearing of point P from point R

Q-34 **For the diagram below, calculate, giving reasons, the sizes of the angles marked a to i, in that order.**

Q-35 **In the diagram below, $\angle$ABC = 90° and BD ■ AC with D on BC.**

a) State which two other triangles are similar to ■ABC. Write your answer in the form ■ABC ||| ■… ||| ■….

b) If AB : BD : AD = 7 : 6 : 3 and BC = 51 mm, use similarity (not Pythagoras) to calculate, correct to the nearest tenth of a millimetre: (i) AC (ii) AB (iii) CD (iv) BD

Q-36 **In the diagram below, PQRS is a parallelogram and RT/ST = 1/2. Determine the following ratios.**

a) RU/UV

b) RU/RV

c) RU/PR

d) UV/PV

Q-37 **A post was advertised and a number of applicants submitted their CVs. The personnel manager analysed these CVs to see how many previous jobs each applicant had held. The results are summarised in this frequency table.**

a) Write down the numbers and tallies that are missing in the table.

b) How many applicants applied for the position?

c) How many applicants had no previous experience?

d) Calculate: (i) the mean (ii) the median (iii) the mode (iv) the range of previous jobs held by the applicants.

Q-38 **The ages of the applicants in Exercise 1.14 are summarised in the table below.**

a) Estimate the mean age of the applicants.

b) Estimate the median age of the applicants.

c) Find the modal class of this data.

d) Comment on possible values of the range for this data.

Q-39 **Represent the data in the frequency table below in a histogram.**

Q-40 **Represent the data in the frequency table below in a histogram.**

Chapter-2 Topic 2 Logarithms

Q-1 **Write each of the following numbers in standard form.**

a) 504 010

b) 0.061

c) 0.101

d) 0.0014253

e) 0.0000987

f) 100 000 000

g) 0.00020304

h) 12 856.023

i) 0.000000181

Q-2 **The population of Nigeria is estimated to be 178.5 million. Write this in standard form.**

Q-3 **The population of Africa is estimated to be 1.112 billion. Write this in standard form.**

Q-4 **What percentage of the population of Africa live in Nigeria?**

Q-5 **Simplify each of the following.**

a) log■ 27

b) log■ 64

c) log■■ 32

d) log■■ + log■■■

e) log■ 405 – log■ 5

f) log■ 25 – log■ 9

g) log■■ 125

h) (log■■ 121 + log■■ 144) ÷ log■■ 169

Q-6 **Write the following as logarithms with base 10.**

a) log■ 24

b) log■ 54

c) log■ 405 – log■ 5

d) log■ 27 × log■ 81

e) log■ 9 + log■ 4

f) log■ 64 + log■ 16

Q-7 **Simplify each of the following.**

a) log■ x + log■ y

b) log x^2 + log x

c) log_p p^3 × log_q q■

d) log■ y■ – log■ y^2

e) log 10■

Q-8 **State the characteristics of the logarithms of the following numbers.**

a) 1.806

b) 1 542

c) 90 800

d) 67.03

Q-9 **State the four-digit number that gives the mantissa of the logarithm of each number.**

a) 1.806

b) 1 542

c) 90 800

d) 67.03

Q-10 **Use tables to find the logarithms of the following numbers.**

a) 513.4

b) 69.47

c) 8.93

d) 1.823

Q-11 **Use tables to find the antilogarithms of each number.**

a) 3.000

b) 2.386

c) 1.027

d) 0.416

Q-12 **Use log tables to calculate the following.**

a) $\sqrt{((23.09 \times 4.5) \div 3.8)}$

b) 6.09^2

c) $\sqrt{(43 \div 6.2)}$

d) ■581.4

e) $\sqrt{((1.85 \times 3.12) \div (23.06 \div 5.54))}$

f) 1.62^3

g) $\sqrt{(2.34 \times 1.86)}$

h) ■(89.6 ÷ 41.4)

i) $\sqrt{((68.09 \div 35.2) \div (7.23 \times 3.06))}$

j) $1 \div (4.183^3)$

Q-13 **Express these decimals as powers of 10.**

a) 0.65

b) 0.347

c) 0.801

d) 0.0632

e) 0.0922

f) 0.00879

g) 0.000701

h) 0.000123

Q-14 **Evaluate.**

a) 10^1■.203

b) 10^2■.651

c) 10^3■.896

d) 10^4■.091

e) 10^1■.654

f) 10^3■.513

g) 10^2■.011

h) 10^5■.753

Q-15 **Evaluate each of the following.**

a) 1.97 × 0.875

b) 2 × 0.00855 × 0.03771

c) (0.64 × 1.04) ÷ (1.98 × 0.02)

d) $(1.3 \times 0.0651 \times 0.0423)^2$

Q-16 **Evaluate each of the following.**

a) 1.89/2.27

b) 0.0752/0.517

c) 1.939/1.927

d) 2.438/0.7802

Q-17 **Evaluate each of the following.**

a) √0.1695

b) ■0.6283

c) (0.07573)^–1.5

d) √(0.735 × 0.071)

Q-18 **Evaluate each of the following.**

a) (2.76/72.3)^(1/2)

b) √((3.05 × 0.062)/43.1)

c) ■√(0.095/(0.64 × 0.18))

d) (0.608)^(3/2)

Q-19 **Solve for x.**

a) $\log_{\blacksquare} 25 = \frac{1}{2}$

b) $\log x = 3$

c) $\log_{\blacksquare} 144 = 2$

d) $(\log_{\blacksquare} x)^2 = 36$

e) $\log x = \log 3 + \log 4$

f) $\log x = \log 119 - \log 7$

g) $x = \log_{\blacksquare} 12 - \log_{\blacksquare} 3$

h) $x = \log_{\blacksquare} 100 - \log_{\blacksquare} 4$

i) $x = \log_{\blacksquare} 54 + \log_{\blacksquare} 4$

j) $\log_{\blacksquare} x = \log_{\blacksquare} 9 + \log_{\blacksquare} 16$

Q-20 **Calculate using logarithmic tables**

a) log 3.014

b) log 0.04625

c) 0.734 × 1.609

d) 43.61 ÷ 8.293

e) $(4.021)^3$

f) $\sqrt[\blacksquare]{((15.23)^2)}$

Q-21 **Calculate using a scientific calculator**

a) log 3.014

b) log 0.04625

c) 0.734 × 1.609

d) 43.61 ÷ 8.293

e) $(4.021)^3$

f) $\sqrt[\blacksquare]{((15.23)^2)}$

Chapter-3 Topic 3 Approximations

Q-1 **Round the following numbers to the nearest 1 000.**

a) 63 954

b) 123 456

c) 7 290

Q-2 **Round the following numbers to the nearest million.**

a) 4 894 653 000

b) 9 015 714 805

c) 1 574 900 000

Q-3 **Round the following numbers to two d.p.**

a) 12.734

b) 5.976

c) 0.0602

Q-4 **Round the following numbers to three d.p.**

a) 2.0723

b) 0.7316

c) 0.00654

Q-5 **Round the following numbers to two significant figures.**

a) 58 699

b) 8.540

c) 205.05

Q-6 **Round the following numbers to three significant figures.**

a) 0.01010

b) 0.06540

c) 0.00205

Q-7 **If Nigeria produces 2.5 million barrels of oil per day:**

a) calculate how many barrels are produced in five years

b) write the answer to the nearest trillion barrels

Q-8 **Without using a calculator, estimate the answers to the following.**

a) 78.24 + 251.30

b) 269.54 – 141.06

c) 37.96 × 62.14

d) 78.24 ÷ 51.30

e) $(4.9)^3 \div (1.15)^2$

f) 685 ÷ (49 × 11)

g) (37.8 + 62.9) ÷ (58.5 – 37.8)

h) 456.7 × 1.9 ÷ (61.4 ÷ 1.98)

Q-9 **Decide which category of accuracy each example should belong in and round off appropriately.**

a) The mass of a tin of beans is 342 g.

b) A car's maximum speed is 183 km/h.

c) A cake needs 496.5 g of flour.

d) The population of Africa is 1.166 billion people.

Q-10 **Calculate the following, giving your answer to an appropriate degree of accuracy.**

a) 18.2 cm × 5.3 cm

b) 48 mm + 59 mm + 71 mm

c) $\sqrt{(65/4)}$

d) $2\pi \times 6.39$

Q-11 **Estimate using the diagrams.**

a) Estimate the area of the triangle shown in the diagram.

b) In the diagram MN = 10 m, MR = 6 m and NT = 3 m. Estimate the length of TR to one decimal place.

Q-12 **Without your calculator, estimate the following.**

a) $\sqrt{30}$

b) $\sqrt{175}$

Q-13 **One mile is 1 760 yards. Estimate the number of yards in 29 miles.**

Q-14 **A cuboid's dimensions are given as 4.968 cm by 3.2 cm by 2.8 cm. Estimate the volume of the cuboid to the nearest cubic centimetre.**

Q-15 **Estimate the area of a circle with diameter 17.25 cm and write your answer to the nearest cm².**

Q-16 **The radius of Isikwe's bicycle wheel is 31.5 cm. How far has he cycled when the wheel has rotated 895 times? Estimate your answer and write it to the nearest metre.**

Q-17 **Nigeria has a total area of 923 768 km² and a population of 181 015 000 people. Estimate the average number of people per square kilometre.**

Q-18 **(i) Give the lower and upper bounds of each of the following numbers. (ii) Using x as the number, express the range in which the number lies as an inequality.**

a) 8

b) 6.3

c) 0.9

d) –0.4

Q-19 **A boy's mass was measured to the nearest 0.1 kg and recorded as 63.8 kg. a) Give the lower and upper bounds of the mass. b) Using m as the number, express the range in which the number lies as an inequality.**

Q-20 **If a length is given as 5.3 m to the nearest 0.1 m, find the upper and lower bounds.**

Q-21 **At a sports day, the winning time for the 400 m race was measured as 48.7 s. a) Give the lower and upper bounds of the time. b) Using t as the number, express the range in which the number lies as an inequality.**

Q-22 **The time it takes the Earth to rotate around the Sun is given as 365.25 days, correct to two d.p. What are the upper and lower bounds of this time?**

Q-23 **Calculate the percentage error in each of the following.**

a) Mr Okonkwo expected 48 people to turn up for a job interview, but only 40 people turned up.

b) Mobo expected to pay ■1 500 for his meal at a restaurant, but only paid ■1 390.

c) Chinasa tries to read 50 pages of her book every day. In one week (seven days) she only managed to read 280 pages.

d) The weight of a box of fruit is given as 5.5 kg, but the actual weight is 5.8 kg.

e) The report said the car park held 360 cars, but we counted only 345 parking spaces.

f) The weather forecast predicted 20 mm of rain, but we actually got 25 mm.

Q-24 **What is the percentage error in using 3.14 as an approximation for π (3.141592653589793…)?**

Q-25 **30 000 fans were expected to attend a football match and only 27 985 arrived at the stadium. Calculate the percentage error.**

Q-26 **Calculate $(1.25)^2$ using logarithm tables and also using a scientific calculator. What is the percentage error?**

Q-27 **A woman expected to spend ■12 000 shopping but actually spent ■12 350. Determine the percentage error, correct to one decimal place.**

Q-28 **Ikenna does an experiment to find how long it takes an apple to drop 2 m. The theoretical value is 0.64 s but he measures 0.62 s. Calculate the percentage error.**

Chapter-4 Topic 4 Sequences and series

Q-1 **Write down the next three terms for each of the following number sequences.**

a) 2, 4, 6, 8, …

b) 99, 97, 95, 93, …

c) 4, 12, 36, 108, …

d) 81, 27, 9, 3, …

e) 1, –2, 3, –4, 5, …

f) 1, 4, 9, 16, …

g) 1, 1, 2, 3, 5, 8, …

h) 3, 6, 11, 18, 27, …

i) p, p^2, p^3, p■, …

j) a – b, 2a – 2b, 3a – 4b, 4a – 8b, …

Q-2 **For each of the following number patterns, say whether it is an arithmetic progression or not. If it is an arithmetic progression, write down the common difference.**

a) 2, 7, 12, 17, …

b) 6, 8, 9, 11, …

c) 15, 10, 5, 0, …

d) 29, 32, 35, 38, …

e) 1, –3, 5, –7, …

f) 21, 14, 7, 0, …

g) 1/2, 1/3, 1/4, 1/5, …

h) a^2, a^3, a■, a■, …

i) x + y, x + 2y, x + 3y, x + 4y, …

j) p + q, 2p, 3p – q, 4p – 2q, …

Q-3 **Write down the first five terms of the arithmetic progression of which:**

a) the first term is 3 and the common difference is 9

b) the first term is 71 and the common difference is –10

c) the first term is 8.1 and the common difference is –0.2

d) the first term is –25 and the common difference is 3

e) the first term is xy and the common difference is 2xy

Q-4 **Write down the next three terms of each of the following arithmetic progressions.**

a) –4, 3, 10, 17, …

b) 5, 1, –3, –7, …

c) –100, –82, –64, –46, …

d) 5.5, 5.7, 5.9, 6.1, …

e) 4p – 3q, 3p – 2q, 2p – q, p, …

Q-5 **Find the formula (in its simplest form) for the nth term of each of the following arithmetic progressions, if:**

a) a = 1, d = 7 → a■ = 1 + 7(n–1)

b) a = 13, d = –3 → a■ = 13 – 3(n–1)

c) a = –11, d = 2 → a■ = –11 + 2(n–1)

d) a = 2, d = ½ → a■ = 2 + ½(n–1)

e) a = 42, d = –2.5 → a■ = 42 – 2.5(n–1)

f) a = x, d = x → a■ = x + x(n–1)

Q-6 **Find the formula for the nth term of each of the following arithmetic progressions. Write your answers in their simplest form.**

a) 11, 14, 17, 20, … → a■ = 11 + 3(n–1)

b) 1, 8, 15, 22, … → a■ = 1 + 7(n–1)

c) –4, 1, 6, 11, … → a■ = –4 + 5(n–1)

d) 39, 29, 19, 9, … → a■ = 39 – 10(n–1)

e) –6, –5.6, –5.2, –4.8, … → a■ = –6 + 0.4(n–1)

f) 8, 7.5, 7, 6.5, … → a■ = 8 – 0.5(n–1)

Q-7 **Calculate the first term and the common difference of an arithmetic progression, if the nth term of the progression is given by the formula:**

a) T■ = 2n + 6

b) T■ = –n + 2.5

c) T■ = –3n – 10

d) T■ = ½n + ¾

e) T■ = 15 – 13n

f) T■ = 1.6n – 0.8

Q-8 **Calculate the number of terms in each of the following arithmetic progressions.**

a) T■ = 5n – 21, last term = 99

b) T■ = –n + 3, last term = –27

c) T■ = –7n + 9, last term = –327

d) T■ = 3.5n + 8.5, last term = 166

Q-9 **The nth term of an arithmetic progression is given by the formula T■ = 2n + 13.**

a) Find the 61st term.

b) Which term is equal to 61?

Q-10 **If the 12th term of an arithmetic progression is –99 and the 30th term is 63, calculate:**

a) the first term and the common difference

b) the 17th term

c) the number of terms in the progression, if the last term is 0

Q-11 **The last two terms of an arithmetic progression are 10 and 2. If there are 32 terms in the progression, find the 16th term.**

Q-12 **Find the arithmetic mean of the following pairs of numbers.**

a) 10 and 48

b) –14 and 0

c) –21 and 19

d) ¼ and ¾

e) 0.6 and 3.5

f) –12.2 and 16.8

g) –362 and –204

h) 5/6 and 6/7

Q-13 **Insert two arithmetic means between 32 and 53.**

Q-14 **Insert five arithmetic means between –18.5 and –5.**

Q-15 **Find the sum of the first 20 terms of each arithmetic progression.**

a) 2, 11, 20, 29, …

b) 40, 30, 20, 10, …

c) 7.5, 14, 20.5, 27, …

d) 342, 302, 262, 222, …

e) –51, –48, –45, –42, …

f) 63, 56, 49, 42, …

Q-16 **Find the sum of the first 49 terms of each arithmetic progression.**

a) 17, 16, 15, 14, …

b) 92, 110, 128, 146, …

c) 64.2, 63.8, 63.4, 63.0, …

d) –750, –725, –700, –675, …

e) 2.5, 1.0, –0.5, –2.0, …

f) –11.0, –8.9, –6.8, –4.7, …

Q-17 **Find the sum of each arithmetic progression for which the first and last terms are given.**

a) T■ = 15 and T■■ = 899

b) T■ = –22 and T■■ = 122

c) T■ = 4.4 and T■■ = 85

d) T■ = –183 and T■■ = –1

e) T■ = –0.3 and T■■ = 23.7

f) T■ = 192 and T■■ = 362

Q-18 **Calculate each of the following series.**

a) 1 + 2 + 3 + 4 + … + 999

b) 3 + 9 + 15 + 21 + … + 195

c) 1.25 + 1.5 + 1.75 + 2 + … + 23.5

d) –15 – 17 – 19 – 21 – … – 73

e) 105 + 78 + 51 + 24 + … – 840

f) 100 – 4 + 99 – 8 + 98 – 12 + … + 1 – 400

Q-19 **Coins are arranged in piles. The first pile contains six coins and each successive pile contains two more coins than the previous one.**

a) How many coins will the 20th pile contain?

b) How many coins will there be in the first 50 piles?

c) What pile will contain 300 coins?

Q-20 **In a competition, the prize money is divided as follows. The person in tenth place gets ■2 500 and every other prize winner gets ■1 500 more than the person who finished just after them. Prizes are awarded for the top ten places.**

a) How much money does the winner get?

b) In what place does the person who gets ■10 000 finish?

c) What is the total prize money for the event?

Q-21 **After being injured in a football match, a player was advised to start a gradual jogging programme. In the first week, he must jog for ten minutes each day for six days of the week. Each week after that, he must jog for five minutes more every day for six days of the week.**

a) How many minutes will he jog in the first week?

b) How many minutes will he jog in the second week?

c) How many minutes will he have jogged altogether by the end of the ninth week?

Q-22 **Bimpe is working hard to save money. Every week, she saves ■500 more than in the previous week. In the first 10 weeks, she saves ■35 000 in total.**

a) How much money did she save in the first week?

b) How much will she have saved altogether by the end of the first year? (52 weeks)

Q-23 **You are given the following information: The sum of the interior angles of a triangle is 180°, quadrilateral 360°, pentagon 540°.**

a) Explain why these angle sums form an arithmetic progression.

b) Calculate the sum of the interior angles of a dodecagon (12 sides).

c) How many sides does a polygon have if the sum of its angles is 5 400°?

Q-24 **For each of the following number patterns, say whether it is a geometric progression or not. If it is a geometric progression, write down the first term and the common ratio.**

a) 1, 5, 9, 13, …

b) 1, 5, 25, 125, …

c) ½, ¼, ■, 1/16, …

d) 32, 16, 8, 4, …

e) 1, 4, 16, 32, …

f) a^2, a^3, a■, a■, …

g) 216, 36, 6, 1, …

h) a, 2a, 3a, 4a, …

i) –99, 33, –11, 11/3, …

j) 1, 2/5, 0.16, …

Q-25 **Write down the first five terms of the geometric progression of which:**

a) the first term is 1 and the common ratio is 4

b) the first term is 81 and the common ratio is ■

c) the first term is 7 and the common ratio is 7

d) the first term is 625 and the common ratio is 0.2

e) the first term is xy and the common ratio is 2xy

Q-26 **Write down the next three terms of each geometric progression.**

a) 8, 16, 32, 64, …

b) –1.5, –3, –6, –12, …

c) –2 187, 729, –243, 81, …

d) 0.24, 1.2, 6, 30, …

e) a/b, $a^2/(2b)$, $a^3/(4b)$, a■/(8b), …

Q-27 **Find the formula (in its simplest form) for the nth term of each of the following geometric progressions, if:**

a) a = 1 and r = 7

b) a = 5 and r = –2

c) a = –10 and r = 3

d) a = 32 and r = ½

e) a = –9 and r = ■

f) a = x and r = x^2

Q-28 **Find the formula for the nth term of each geometric progression. Write your answers in their simplest form.**

a) 1, 2, 4, …

b) 5, 10, 20, …

c) 20, 30, 45, …

d) 100, 10, 1, …

e) 2.5, 25, 250, …

f) 1, 0.1, 0.01, …

Q-29 **Show that the nth term of the geometric progression –256, 64, –16, … is given by the formula T■ = (–1) × 4■■■.**

Q-30 **Calculate the first term and the common ratio of a geometric progression, if the nth term of the progression is given by the formula:**

a) $T_n = 4 \times 5^{n-1}$

b) $T_n = -6 \times 2^n$

c) $T_n = 7 \times (-2)^{n-1}$

d) $T_n = 8^{n-1}$

e) $T_n = (-2.5)^n$

f) $T_n = 10 \times (\frac{1}{2})^{n-1}$

Q-31 **Calculate the number of terms in each of the following geometric progressions, if:**

a) $T_n = 80 \times (\frac{1}{2})^{n-1}$ and the last term is 5/8

b) $T_n = (-2)^{n-1}$ and the last term is –512

c) $T_n = -6 \times 4^{n-1}$ and the last term is –6 144

d) $T_n = 1.5 \times 3^{n-1}$ and the last term is 364.5

Q-32 **The nth term of a geometric progression is given by the formula $T_n = 1.5^n$.**

a) Find the fifth term.

b) Which term is equal to 2187/128 ?

Q-33 **If the sixth term of a geometric progression is 320 and the 11th term is 10 240, calculate:**

a) the first term and the common ratio

b) the fourth term

c) the number of terms in the progression, if the last term is 20 480

Q-34 **The last two terms of a geometric progression are 96 and 192. If there are 9 terms in the progression, find the fifth term.**

Q-35 **Find two possible values for the geometric mean, x, of:**

a) 9 and 81

b) 16 and 1

c) –20 and –5

d) 1/9 and 1

e) 3.5 and 14

f) 25/3 and 1/3

g) 153 and 17

h) –0.2 and –3.2

Q-36 **Insert two geometric means between:**

a) 4 and 108

b) –337.5 and –0.1

Q-37 **Insert three geometric means between 22 and 111.375. Find all the possibilities.**

Q-38 **Find the sum of the first 20 terms of each geometric progression:**

a) 1, 2, 4, 8, …

b) 6, –12, 24, –48, …

c) 5, 1, 0.2, 0.04, …

d) –3, –1, –1/3, –1/9, …

e) 70, 35, 17.5, 8.75, …

f) 7, 1, 1/7, …

Q-39 **Given the geometric progression –100, –50, –25, …:**

a) Find the sum of the first 5 terms.

b) Find the sum of the first 10 terms.

c) Find the sum of the first 20 terms.

d) What do you notice about your answers to questions a), b) and c)?

Q-40 **Which of the following geometric progressions will have a sum to infinity? Give a reason for your answer each time.**

a) 5, 20, 80, …

b) 1/4, 1/12, 1/36, …

c) 216, 36, 6, …

d) –1.25, 0.25, –0.05, …

e) 12, 72, 432, …

f) 100, –80, 64, …

g) 5, 1, 0.2, …

h) 20, 22, 24.2, …

i) 50, 30, 18, …

j) 1, 0.1, 0.01, …

Q-41 **Find the sum to infinity of each of the convergent geometric progressions in question 1.**

Q-42 **Find the first three terms of the geometric progression of which the common ratio is –0.2 and the sum to infinity is 5.**

Q-43 **A rabbit colony started out with a pair of rabbits that had babies. If the size of the colony doubled every three weeks, what was the size of the colony after 30 weeks?**

Q-44 **During an outbreak of the Ebola virus, health workers gathered the following information: by the end of the first week 982 people were infected; thereafter the number increased by 9% per day. Approximately how many people were infected by the end of the second week? Round to the nearest whole number.**

Q-45 **A child dropped a ball from a first-floor balcony. It fell 5 m to the ground and thereafter bounced along the road. If the height of every bounce was 2/3 of the previous height, how far had the ball travelled by the time it came to rest? Round to the nearest metre.**

Q-46 **Abayomi obtained 46% in his first math test and aimed to improve by 10% in each subsequent test. How many tests must he take to reach at least 80%?**

Q-47 **A mine worker discovered an ore sample containing 650 mg of radioactive material with a half-life of two days. Calculate the amount of radioactive material remaining after two weeks.**

Chapter-5 Topic 5 Quadratic equations

Q-1 **Factorise these expressions.**

a) $16ax – 32xy + 8axy$

b) $4a^2 – 2a$

c) $25a^2b + 50ab^2$

d) $16x^2 – 25y^2$

e) $3y^2 – 11y + 6$

f) $81 – a^2$

g) $4x^2 + 8x – 60$

h) $a^2 + 8a + 16$

Q-2 **Find the constant k that makes these expressions perfect squares.**

a) $x^2 - 8x + k$

b) $x^2 + 20x + k$

c) $x^2 - 6x + k$

d) $x^2 + 16x + k$

e) $x^2 - 12x + k$

f) $x^2 + 14x + k$

g) $9x^2 + 6x + k$

h) $16x^2 + 24x + k$

Q-3 **Solve for x.**

a) $4x^2 - 1 = 0$

b) $x^2 - 5x + 6 = 0$

c) $x^2 - 20x = 0$

d) $2x^2 - 6x = 0$

e) $x^2 - 7x + 12 = 0$

f) $x^2 + 14x + 49 = 0$

g) $64x^2 = 1$

h) $x^2 - 6x + 9 = 0$

Q-4 **Solve for x by factorising.**

a) $x^2 - 10x + 25 = 0$

b) $x^2 - 18x + 81 = 0$

c) $x^2 - 16x + 64 = 0$

d) $2x^2 - 8x + 8 = 0$

e) $4x^2 + 20x + 25 = 0$

f) $3x^2 - 30x + 75 = 0$

g) $9x^2 + 6x + 1 = 0$

h) $25x^2 - 60x + 36 = 0$

Q-5 **Find the constant k which makes the quadratic equations a perfect square.**

a) $x^2 - 12x + k = 0$

b) $x^2 + 18x + k = 0$

c) $x^2 - 22x + k = 0$

d) $x^2 - 28x + k = 0$

e) $x^2 + 14x + k = 0$

f) $2x^2 - 8x + k = 0$

g) $9x^2 - 6x + k = 0$

h) $4x^2 + 12x + k = 0$

Q-6 **Solve the following equations by completing the square. Leave the answer in simplified surd form where necessary.**

a) $x^2 - 4x - 7 = 0$

b) $x^2 + 8x - 5 = 0$

c) $x^2 - 6x - 12 = 0$

d) $-2x^2 - 3x + 8 = 0$

e) $x^2 + 7x - 11 = 0$

f) $3x^2 - 12x + 10 = 0$

g) $2x^2 + 4x - 3 = 0$

h) $9x^2 - 24x + 2 = 0$

Q-7 **Solve these quadratic equations (leave your answers in surd form).**

a) $x^2 - 3x - 1 = 0$

b) $-3x^2 - 10x + 4 = 0$

c) $x^2 + 2x - 1 = 0$

d) $5x^2 - 20x - 20 = 0$

e) $3x^2 + 2x - 4 = 0$

f) $-ax^2 - bx + c = 0$

Q-8 **Solve for x, correct to two decimal places where necessary.**

a) $3x^2 - 7x + 1 = 0$

b) $5x^2 - x - 3 = 0$

c) $-x^2 + 4x - 2 = 0$

d) $3x^2 - x - 1 = 0$

e) $2x^2 - x - 2 = 0$

f) $3x^2 - 7x + 3 = 0$

Q-9 **Write $x^2 - 7x + 17$ in the form $(x - a)^2 + b$, where a and b are constants. Hence state the minimum value of $x^2 - 7x + 17$.**

Q-10 **If the solution to an equation is $x = (-2 \pm \sqrt{(2p + 5)})/7$, for which values of p will the equation be a perfect square?**

Q-11 **For which values of k will $2x^2 + kx + 18 = 0$ have equal roots?**

Q-12 **Find the equation that has these roots.**

a) $-2; 3$

b) $6; 7$

c) $\frac{1}{4}; 2$

d) $3; -3$

e) $-2 \pm \sqrt{3}$

f) $3 \pm \sqrt{11}$

g) $k; -k$

h) k■; k■

Q-13 **For which values will the following have equal roots?**

a) $2x^2 + (p - 3)x + 8 = 0$ (find p)

b) $2x^2 - 2x - k = 0$ (find k)

Q-14 **The roots of a quadratic equation are 4 and −3. Write down the equation in the form $ax^2 + bx + c = 0$.**

Q-15 **Given one root of each equation, find the parameter and the other root.**

a) One root of $kx^2 - x - 2k = 0$ is $\frac{3}{4}$. Find k and the other root.

b) One root of $x^2 + kx - 3 = 0$ is -1. Find k and the other root.

c) One root of $2x^2 + ax + 6 = 0$ is ⅗. Find a and the other root.

d) One root of $px^2 - 5x + p = 0$ is ½. Find p and the other root.

Q-16 **If the roots of $x^2 + kx + 4 = 0$ are equal, find the roots of $x^2 + kx - 6 = 0$, correct to two d.p.**

Q-17 **An experienced house painter will take two hours less to paint a wall than her apprentice. Working together, they can paint the wall in 4 4/9 hours. How long would it take the experienced painter to paint the wall if she was working on her own?**

Q-18 **A group of students go to a café for some sodas after an exam. The bill totals ■2 880 and must be paid by the group. Six students are unable to pay so all the others must pay an extra ■40 each. Determine the number of students in the group.**

Q-19 **A train covers a distance of 60 km at a constant speed. One day, due to bad weather, the train travels 10 km/h slower. The journey takes half an hour longer. Calculate the normal speed of the train.**

Q-20 **Chinomso took part in a 90 km endurance running race. He ran the race at a speed of 5 km/h slower than when he ran it a few years earlier. The race took him three hours longer to run than his earlier time. At what average speed did he run when he ran the race a few years earlier?**

Q-21 **The sum of the squares of two consecutive odd numbers is 290. What are the two numbers?**

Q-22 **Kunmi and Mayowa work together to set up a new website in six hours. When working alone, Mayowa takes five hours longer than Kunmi to set up the website. How long would it take Kunmi to set up the website on his own?**

Chapter-6 Topic 6 Simultaneous equations

Q-1 **Solve by elimination the following pairs of simultaneous equations.**

a) $x + y = 14$ and $x - y = 2$

b) $x + y = -1$ and $2x - y = -3$

c) $2x + y = 5$ and $2x - y = 3$

d) $x + 3y = 6$ and $-x + 8y = 5$

e) $2x + y = 13$ and $x - y = 2$

f) $3x - y = 9$ and $4x - y = 14$

Q-2 **Solve by elimination the following pairs of simultaneous equations.**

a) $x + 2y = 11$ and $2x + 3y = 6$

b) $5x + 3y = 23$ and $x + 2y = 6$

c) $2x - y = 3$ and $3x + 2y = 8$

d) $2x + y = 8$ and $5x - y = 6$

e) $2x + y = 5$ and $x + 3y = 5$

f) $x + 2y = 8$ and $2x + 3y = 14$

Q-3 **Solve by elimination the following pairs of simultaneous equations.**

a) $3x + y = 10$ and $x - y = 2$

b) $3x + y = 2$ and $6x - y = 25$

c) $3x + 2y = 7$ and $4x + 3y = 15$

d) $4x + 3y = 24$ and $3x + 4y = 25$

e) $3x - 2y = 5$ and $(2/3)x + (1/2)y = -7/9$

f) $6x + 2y = 20$ and $0.5x - 0.5y = 1$

Q-4 **If y = ax + b, find the values of a and b given that y = 6 when x = 1 and y = 10 when x = 2.**

Q-5 **Use the substitution method to solve these simultaneous equations.**

a) $2x + y = -3$ and $x - y = -3$

b) $x - y = 4$ and $7x + 2y = 19$

c) $x - y = -5$ and $x + y = -1$

d) $x + 2y = 1$ and $2x + 3y = 4$

e) $3x - y = 5$ and $2x + 5y = 9$

f) $2x - y = 4$ and $6x - 5y = 18$

Q-6 **Use the substitution method to solve these simultaneous equations.**

a) $x + 8y = 21$ and $3x + 2y = 19$

b) $5x + y = 7$ and $8x - 3y = 2$

c) $4x + y = 13$ and $3x - 2y = 7$

d) $x - 3y = -5$ and $3x + 2y + 4 = 0$

e) $3x + 4y = 24$ and $2x - y = 5$

f) $3x - y = 17$ and $2x + 5y = 0$

Q-7 **Use substitution to determine constants in functional relationships.**

a) If $y = ax + b$, find a and b given $y = 2$ when $x = 4$ and $y = -1$ when $x = 1$

b) If $y = ax^2 + bx$, find a and b given $y = 2$ when $x = 2$ and $y = -1$ when $x = 1$

Q-8 **Solve for x and y.**

a) 5■²■■■■ = 25■ and 2■■■■■■ = ¹■/■

b) 2■■■²■■ = 64 and 5■²■■■■ = 625

c) (27■)/9 = 81■²■■■■ and x = ■4■

d) 3■ = 81■ and y = x²■6x+9

e) 3■²■■■■ = 27 and 2■■■²■■ = 1

f) 2■²■■■■ = 128 and 3■■■²■■ = 27¹■/■

g) 4■²■■ = 4×8■³■■■■ and 3■²■■■■ = 1

h) 25×5■²■■■■ = 125■ and 3■²■■■■■ = 81

i) 2■ = 4■■■³■ and $x^2+y^2 = 20$

j) 4■■■²■■ = 16¹■/■ and 3■³■■■■■ = 81

Q-9 **Give the equations of the following straight lines.**

a)

b)

c)

d)

e)

f)

Q-10 **Calculate the point of intersection of the following straight lines.**

a)

b)

c)

Q-11 **Use the substitution method to solve these simultaneous equations.**

a) $x + y = 4$; $xy = 4$

b) $x + y = 3$; $xy = -4$

c) $x - y = 2$; $x^2 + y^2 = 20$

d) $x + y = 3$; $x^2 + y^2 = 89$

e) $5x - y = 2$; $y = 3x^2 - 2x - 8$

f) $y - 2 = 3x$; $y = 3x^2 + 6x - 4$

Q-12 **Use the substitution method to solve these simultaneous equations.**

a) $y = 3x + 2$; $y = -x^2 + 2x + 8$

b) $y = \frac{1}{2}x^2 + x - 3/2$; $y = -x^2 - 5x + 6$

c) $x + 4y = 9$; $y = -1/(x - 1) + 2$

d) $x - 3y = 10$; $y + 2 = 3/(x - 4)$

e) $2x + y = 2$; $2x^2 + y^2 = 3xy$

f) $x = y + 1$; $y = 4/x + 2$

Q-13 **Solve for x and y if:**

a) $x - 4 = 2y$ and $x^2 - xy - y^2 = -16 + 24y$

b) $x - 2y = -4$ and $y = -4/(x - 5)$

e)

f)

Q-14 **Solve the following simultaneous equations.**

a) $x - 2y = 3$ and $x^2 - 5xy + 3y = 3$

b) $2y - x - 2 = 0$ and $x^2 + xy - 5x + 3y = 3$

c) $3x = 10 - y$ and $2x^2 - 7xy + 3y^2 = 0$

d) $2x - y = 5$ and $4x^2 - 4xy + 3y^2 = 43$

f)

Q-15 **Determine the point(s) of intersection of the pairs of graphs.**

a) $y = x^2 - 9$ and $y = -3x + 9$

b) $y = 3x^2 - 3$ and $y = -3x + 3$

c) $y = -2x^2 + 8$ and $y = x + 2$

d) $y = x - 1$ and $y = x^2 - 1$; determine the length AB

e) $y = -3x + 9$, $y = -x^2 + 9$ and $y = x + 3$; determine the coordinates of the points A, B, C, D, F and G

f) Sketch $y = -x^2 - 4x$ and $y = x + 6$ on the same set of axes and solve $-x^2 - 4x = x + 6$

Q-16 **Solve the following word problems.**

a) The area of a rectangle is 60 m². The length is 4 m longer than the width. Find the dimensions.

b) The length of a rectangle is four times its breadth. The perimeter of the rectangle is 80 m. Calculate the measures of the length and breadth of the rectangle.

c) The base of a triangle is 6 cm longer than its height. The area of the triangle is 8 cm². Determine the base and the height of the triangle.

d) The sum of Lewa's age and Olaniyi's age is 60. Six years ago, Lewa was three times as old as Olaniyi. What is Lewa's age now?

e) Ifede is eight years older than her brother. In three years she will be twice as old as her brother. Find their present ages.

f) One number is 8 more than another number and the sum of the two numbers is 62. Find the numbers.

g) The sum of two numbers is 24. Twice the first number is 3 less than the second number. Find the numbers.

h) The sum of the digits of a two-digit number is 15 and the product of the digits is 56. Find the number.

i) A two-digit number and the number formed by reversing the digits add up to 55. The product of the two numbers is 736. Find the numbers.

j) The sum of the digits of a number on a football player's jersey is 11. If the digits are reversed, the new number is seven more than twice the original number. Find the number.

k) A wallet containing ■4 000 has three times as many ■100 notes as ■500 notes. Find the number of each kind of note.

Chapter-7 Topic 7 Gradient of a curve

Q-1 **Write down the gradient of the following straight lines.**

a) $y = \blacksquare x - 6$

b) $y = -4x + 1$

c) $3y = x - 3$

d) $2y - x = 4$

Q-2 **Calculate the gradient of the line joining the points.**

a) (2; 8) and (1; 4)

b) (3; 5) and (2; 1)

c) (–2; 5) and (6; –1)

d) (–1; –1) and (–3; –7)

Q-3 **Decide whether the following pairs of lines are parallel or perpendicular.**

a) $y = 2x + 5$ and $2y - 4x + 1 = 0$

b) $3y = x - 3$ and $y = -3x + 4$

c) $2y = x - 6$ and $y = \frac{1}{2}x + 2$

d) $y = 4$ and $x = 3$

Q-4 **Gradients from a graph.**

a) Calculate the gradient of the line in the graph.

b) Determine the gradient of a line parallel to that line.

Q-5 **Gradients from a graph.**

a) Calculate the gradient of the line in this graph.

b) Determine the gradient of a line perpendicular to the line in the graph.

Q-6 **Draw rough sketches of the following straight line graphs.**

a) $y = 3x + 6$

b) $y = -2x + 1$

c) $y = -x - 3$

d) $y = \frac{1}{2}x - 1$

e) $x = 4$

f) $y = -3$

g) $3x + y - 4 = 0$

h) $4x + 3y - 12 = 0$

i) $x + 2y = 6$

j) $5x - 4y + 20 = 0$

Q-7 **Find the equations of the following lines.**

a) gradient 4, passing through (0; –1)

b) gradient 3, passing through (–1; 0)

c) gradient –2, passing through (1; 2)

d) gradient –5/3, passing through (10; –1)

Q-8 **Find the equations of the following lines.**

a) y-intercept 6 and passing through (1; 9)

b) y-intercept –2 and passing through (4; –4)

c) y-intercept 3 and passing through (3; –3)

d) y-intercept 4 and passing through (3; –2)

Q-9 **Find the equations of the lines passing through the given pairs of points.**

a) (6; 1) and (2; 4)

b) (–1; 4) and (3; 6)

c) (0; 1) and (2; 1)

d) (6; 1) and (6; 4)

Q-10 **Find the equation of the straight line in each graph.**

a)

b)

c)

d)

Q-11 **Find the equation of the straight line in each graph.**

a)

b)

c)

Q-12 **Determine the equations of the three straight lines in the graphs provided.**

Q-13 **What is the gradient of the tangent to the curve shown in this graph when x = 0?; Write down the equation of the axis of symmetry**

a) What is the gradient of the tangent to the curve shown in this graph when x = 0?

b) Write down the equation of the axis of symmetry

Q-14 **What is the gradient of this curve at point T?**

a) What is the gradient of this curve at point T?

Q-15 **Determine the gradient of the curve shown in the graph at the point (7; 5); Determine the equation of this quadratic function**

a) Determine the gradient of the curve shown in the graph at the point (7; 5).

b) Determine the equation of this quadratic function.

Q-16 **For the graph provided, find the gradient of the curve when x = –1 and when x = 1**

a) Find the gradient of the curve when x = –1.

b) Find the gradient of the curve when x = 1.

Q-17 **Solve :**

a) Find the equation of the line with y-intercept (0; 5) that is parallel to the straight line in the graph.

b) At what point does the line y = –2x + 5 touch the quadratic function?

c) What is the gradient of the quadratic function at the point (1; 3)?

Chapter-8 Topic 8 Linear inequalities

Q-1 **Solve the following inequalities. Represent each solution on a number line.**

a) $5x > 10$

b) $x - 4 < 2$

c) $-x \leq 3$

d) $-7x \geq 1$

e) $8x + 3 > 19$

f) $6 - 2x \geq -4$

g) $3x + 15 < 5 - 2x$

h) $7x - 9 > 3x - 1$

Q-2 **Solve the following inequalities. Represent each solution on a number line.**

a) $3(x + 1) < 7$

b) $x/4 > 2$

c) $-2x/5 \geq -1$

d) $x \leq 5x/3 + 4$

e) $4(3 - x) > 5(1 + x)$

f) $x/4 - x/5 < -3$

g) $2(4x - 3) \geq x + 8$

h) $x \leq 4(x/2 + 1)$

Q-3 **Solve the following compound inequalities. Represent each solution on a number line.**

a) $-1 < x < 5$

b) $0 < 3x \leq 9$

c) $5 \leq 2x + 1 < 7$

d) $-4 \leq 2 + 3x \leq 17$

e) $4 \geq -x > 3$

f) $16 < -2x \leq 8$

g) $-5 \leq 2 - 7x \leq 16$

h) $-12 > 6 - 9x \geq 15$

Q-4 **Solve the following compound inequalities. Represent each solution on a number line.**

a) $-4 \leq 2(x + 5) \leq 10$

b) $1 < 3(x - 2) \leq 13$

c) $-2 < 5(1 - x) < 6$

d) $-1 \leq -3x/5 < 2$

e) $-6 \leq 2x/5 - 4 < 4$

f) $1/3 > -x/5 \geq -1/2$

g) $-7.1 > -x - 2.5 > -3.9$

h) $x + 5 < 3x + 12 \leq x - 3$

Q-5 **Sketch the graph and shade the region that contains the solution for each of the following inequalities.**

a) $3x + 6y < 18$

b) $-4x + 2y \leq -8$

c) $x + 5y \geq -10$

d) $-x + 2y \geq 4$

e) $-4x + 5y \leq 20$

f) $2x + 3y < 6$

g) $3x + y > 9$

h) $-2x + 7y \geq 14$

i) $3x + 8y \geq 24$

j) $-9x + 4y < 36$

Q-6 **Sketch the graph and shade the region that contains the solution for each of the following inequalities.**

a) $0.5x + y > 2$

b) $-1/4\ x + 2/3\ y \leq -1$

c) $5/6\ y + 2/3\ x \geq 3\ 1/3$

d) $0.75x < 1.25y + 3.75$

e) $-0.3x + 0.7y \leq 2.1$

f) $0.125x + 0.675 > 0.375y$

g) $1/7\ x - 1/8\ y - 1 \geq 0$

h) $0 < 0.2x + 0.3y + 0.6$

i) $-2.1x + 1.4y \leq 3.5$

j) $1/4\ x + 5/8\ y \geq 3/4$

Q-7 **Sketch the graphs and shade the region that contains the solution for each of the following pairs of inequalities. Label each line with its inequality, as shown in the examples.**

a) $-5x + 3y \leq 15$ and $3x + 6y \geq -18$

b) $7x + 2y < 14$ and $x + 4y > -4$

c) $-2x + 5y > 10$ and $3x + y \geq 6$

d) $-2x + y \leq 2$ and $3x + 2y < -9$

e) $-5x + 6y \leq 30$ and $7x + y \geq -7$

f) $5x + 4y \geq 20$ and $x + y < 5$

Q-8 **Sketch the graphs and shade the region that contains the solution for each of the following sets of inequalities. Write each inequality next to its line.**

a) $3x + 5y \leq 15$, $-2x + 3y \geq -6$ and $x \geq 1$

b) $6x + 5y < 30$, $-x + y \leq 4$ and $y > 2$

c) $x + y \leq 3$, $-x + y > -3$ and $x \geq -1$

d) $2x + 7y < 14$, $x \geq 0$ and $y \geq 0$

e) $-x + y \geq -2$, $2x + y > -2$ and $y < 5$

f) $-4x + 3y \leq 12$, $y \geq 0$ and $x < 2$

Q-9 **Write down all the constraints for each situation in the form of inequalities.**

a) A factory makes tables and chairs: at most 100 items each week; at least 10 tables; for each table at least four chairs. Let x = tables, y = chairs.

Write the inequalities.

b) A farmer plants cassava and yams on 50 ha: at least 10 ha cassava; at least 15 ha yams; no crop more than 60% of land. Let x = cassava ha, y = yams ha.

Write the inequalities.```

Q-10 **Solve:**

a) A factory makes tables and chairs. The factory can make at most 100 items each week. The factory must make at least 10 tables every week. For each table, there must be at least four chairs. Let x be the number of tables and y be the number of chairs that the factory must make. Write down all the constraints for this situation in the form of inequalities.

b) A farmer produces two main crops: cassava and yams. She has 50 hectares of farmland on which she can plant her crops. She is contracted to plant at least 10 hectares under cassava and at least 15 hectares under yams. She does not want to plant more than 60% of her farmland under any one crop. Let x and y be the number of hectares that she plants under cassava and yams respectively. Write down all the constraints for this situation in the form of inequalities.

Q-11 **Given the inequalities $x \geq 10$, $y \geq 0$, $x + y \leq 100$ and $y \geq 4x$.**

a) Graph these inequalities on a sheet of graph paper.

b) Shade the feasible region.

Q-12 **Given the inequalities $x + y \leq 50$, $x \geq 10$, $y \geq 15$, $x \leq 30$ and $y \leq 30$.**

a) Graph these inequalities on a sheet of graph paper.

b) Shade the feasible region.

Q-13 **Find the coordinates of the vertices labelled A, B and C of the feasible region shown in this diagram.**

Q-14 **Find the coordinates of the vertices labelled A, B, C, D and E of the feasible region shown in this diagram.**

Q-15 **A factory makes x tables and y chairs every week. Formulate the objective function for each of the following scenarios.**

a) If it takes 9 hours to make a table and 7 hours to make a chair, express the total working hours (M) required per week in terms of x and y.

b) If the cost of making a table is ■140 000 and the cost of making a chair is ■95 000, express the total weekly cost (C) in terms of x and y.

c) If the profit on one table is ■65 000 and the profit on one chair is ■42 000, express the total weekly profit (P) in terms of x and y.

Q-16 **A farmer plants x hectares of farmland under cassava and y hectares under yams. Formulate the objective function for each of the following scenarios.**

a) If it takes five labourers to harvest one hectare of cassava and 30 labourers to harvest 1 hectare of yams, express the total number of labourers (L) required in terms of x and y.

b) If one hectare of cassava yields 18 tonnes and 1 hectare of yams yields 30 tonnes, express the total number of tonnes (T) that will be harvested in terms of x and y.

Q-17 **A feasible region has these vertices: A(0; 0), B(0; 160) and C(50; 125). Find the maximum and minimum values of each of the following objective functions.**

a) C = 98 000x + 69 000y, where C is the cost in naira

b) M = 40x + 60y, where M is the number of working hours required

c) A = 5x + 2.5y, where A is the storage space required in square metres

Q-18 **A feasible region has these vertices: A(15; 25), B(15; 195), C(30; 170) and D(45; 115). Find the maximum and minimum values of each of the following objective functions.**

a) F = 800x + 750y, where F is the fuel required in litres

b) T = 20x + 35y, where T is the maintenance time in hours

c) M = 10x + 5y, where M is the mass in tonnes

Q-19 **A brand of fruit juice is made from fresh mangoes and guavas. Every batch must contain at least 60 pieces of fruit, but not more than 90 pieces of fruit. The number of mangoes used must be at least twice, but not more than four times, the number of guavas used. Let x and y be the number of mangoes and guavas used respectively in one batch of juice.**

a) Write down all the constraints for this situation.

b) Graph the inequalities on a sheet of graph paper, shade the feasible region and label the vertices.

c) Find the coordinates of the vertices of the feasible region.

d) If mangoes cost ■250 each and guavas cost ■150 each, what number of each kind of fruit should be used to minimise the cost of making one batch of juice?

Q-20 **A bicycle factory is revamping its assembly section. There is a choice of two types of assembly line. Type A can produce five bicycles per day. It occupies 40 m² of floor space and needs eight skilled workers to operate it. Type B can produce three bicycles per day. It occupies 60 m² of floor space, but needs only four skilled workers to operate it. There is a total amount of 480 m² of floor space available for the assembly lines. Only 64 skilled workers are available. Let x and y be the number of Type A and B assembly lines respectively that are installed.**

a) Write down all the constraints for this situation.

b) Graph the inequalities on a sheet of graph paper, shade the feasible region and label the vertices.

c) Find the coordinates of the vertices of the feasible region.

d) If the objective is to produce the maximum number of bicycles per day, how many of each type of assembly line should be installed?

Chapter-9 Topic 9 Algebraic fractions

Q-1 **Write down the value of x in these equivalent fractions.**

a) x/9 = 1/3

b) 1/x = 40/96

c) x/56 = 6/14

d) 28/48 = 70/x

e) 2x/56 = 6/14

Q-2 **Write each fraction as a common fraction (i.e. not a decimal) in its simplest form.**

a) 24/36

b) 14/42

c) 48/120

d) 56/64

e) 1 2/3

f) 5 3/4

g) 360/96

Q-3 **Simplify these expressions.**

a) 1/2 + 2/3 + 3/4

b) 1/4 + 5/12 – 1/6

c) $3/5 - 1/4$

d) $5/3 \div 3/8 + 3/4$

e) $6/7 \times 8/15$

f) $3/4 \div 1/5$

g) $3/10 \div 5/30$

h) $12/50 \times 15/18$

Q-4 **Simplify as far as possible.**

a) $24/36$

b) $42/14$

c) $4x/12$

d) $5x/30x$

e) $6y/y$

f) $(4-8a)/4$

g) $b■/b^3$

h) $12c/3c^3$

i) $0/10b$

j) $11c^2/0$

Q-5 **Factorise and simplify.**

a) $(a-b)/(2a-2b)$

b) $(x-y)/(y-x)$

c) xy/x

d) $(x^2-y^2)/(x-y)^2$

e) $(ax-a)/(ax+a)$

f) $(2x^2-x)/(4x^2-2)$

g) $(6x^2+9xy)/3x$

h) $6x^2 \times 9xy / 3x$

Q-6 **Simplify as far as possible.**

a) $(8x^2+12x)/4x$

b) $(4x^3-8x)/2x$

c) $(x^2-5x+6)/(x^2-4)$

d) $(x^2-9)/(x^2-7x+12)$

e) $((x-2)^2-1)/(x^2-4x+3)$

f) $(x^2+3x-10)/(x^2+2x-15)$

Q-7 **Fully simplify the following expressions.**

a) $3x/5 + x/4$

b) $(x-1)/2 - (x+1)/3$

c) $(2x+3)/5 + (x-1)/2 + 1$

d) $(5x-3)/5 - (x-4)/4$

e) $3x/2 + 2x + (x+2)/4$

f) $(2x+1)/2 - 1/3 \times (x-6)$

g) $x/5 + 3x/2 - 3x + 1$

Q-8 **Simplify fully.**

a) $2/3 + 3/5$

b) $-2/(x-3) - 4/(x+1)$

c) $-3/x + 2/(x-1)$

d) $1 + y - (2y-1)/2$

e) $-3/(x-2) + 1/(2x+1)$

f) $1/(x^2-1) + 1/(x^2-x)$

Q-9 **Simplify.**

a) $2/y^2 \times 3y/8$

b) $4a^2/5 \div 10/a$

c) $(24x-8)/12 \div (9x-3)/6$

d) $(2a^2-a)/(6a-3) \times 6/a^2$

e) $9xy^2/(x+2) \div 3xy/(x^2-4)$

f) $(x^2y-xy^2)/(x-y) \div xy/3$

g) $(x^2-y^2)/(2x+2y) \times 4/(x-y)$

Q-10 **Fully simplify the following expressions.**

a) $(2y-2)/(y^2-6y) \times (y^2-5y-6)/(y^2-1)$

b) $(4a^2+8a)/(a^2-4) - (4a-12)/(a^2-5a+6)$

c) $(x^2-16)/(x^2-4x) \times (3x-3)/(x^2+3x-4)$

d) $(5xy-15y)/(4x-12) \div (6y^2)/(x+y)$

e) $(x^2+x)/(x^2-2x-3) \div (1-x^2)/(4x+3)$

f) $(x^2-x-2)/(x^2-4) \times (x^2+x)/(2x)$

g) $(a^2-1)/(2a^2-5a+3) \times (6a-9)/(4a+4) \div 3/(4a)$

Q-11 **Simplify fully.**

a) $(1/x + 1/y) \div (y/x - x/y)$

b) $(1/x + 1/x^2) \div (1 - 1/x^2)$

Q-12 **Solve:**

a) If $(3x - y)/(4x + 5y) = 2/3$, determine the value of x/y.

b) If $(5x + 2y)/(2x + 3y) = 3/4$, determine the value of x/y.

c) If $a = (3b - 1)/(b + 2)$, express $(2a - 3)/(3a - 1)$ in terms of b.

d) If $x = (a + 1)/(a - 1)$, express $(x + 1)/(x - 1)$ in terms of a.

e) If $a/b = 6/5$, evaluate $(5a + 6b)/(10a - 3b)$.

f) If $a/b = 3/2$, evaluate $(8a - b)/(6a + 2b)$.

g) Given $(2p - 3q)/(3p - 2q) = 4$, find the value of p/q.

h) If $b/2 = a$, determine the value of $(a^3/b^3 + 1/2) \div (1/2 - a^2/b^2)$.

i) If $p = 2a/(1 - a^2)$ and $q = 2a/(1 + a)$, write $2p - q$ in terms of a.

j) If $x = 4/3$ and $y = -12$, determine the value of $xy - y/x$.

Q-13 **Solve for x and related equations.**

a) $4x/3 - (3x - 4)/6 = 5 - (x - 2)/2$

b) $(x + 5)(x - 6)/2 = (x - 1)(x - 4)/3$

c) $3/(2 - x) + 5/(2 + x) = 2/x$

d) $(2x - 1)/(x + 7) = (x - 2)/(x - 1)$

e) $2x/(5x - 1) = (2x + 1)/[2(x + 1)]$

f) $2x/(x + 1) = (x - 3)/(x^2 + 4x + 3)$

g) $(2x - 3)/(x^2 - 4) - 1/(2x^2 + 3x - 2) = (x - 1)/(2x^2 - 5x + 2)$

Q-14 **Solve:**

a) Mrs Nwamu calculates that if she increases her speed by 10 km/h, she will take 48 minutes less to complete a journey of 240 km. Calculate her original speed.

b) Ngozi travels 400 km to visit his friend in Abuja. He drives by car and travels 20 km/h faster than the train going the same distance. He arrives one hour and forty minutes earlier than the train. If the speed of the train is x km/h, how fast does the train travel?

c) A painter and her apprentice paint a building in 24 days. When each person works separately, the apprentice takes 20 days longer than the painter to complete the job. Calculate the number of days each person would take to complete the job alone.

Q-15 **Solve for x for which the following expressions and equations are undefined.**

a) $6/(x + 3)$

b) $(x - 2)/(2x - 1)$

c) $3x/(5 - x)$

d) $(x + 1)/(4 - 2x) + 1/x$

e) $(2x - 3)/(x - 7) - (x - 3)/(2x + 1)$

f) $4x/(3x - 1) = (5x - 1)/(x + 6)$

g) $1/(x^2 - 1) = (x - 1)/(4x + 3)$

Chapter-10 Topic 10 Logical reasoning

Q-1 **For each of the statements below, say whether it is open or closed. For each closed statement, say whether it is true or false.**

a) No even integers are divisible by 3.

b) 13 – 5 = 8

c) Next Wednesday is a public holiday.

d) Some integers are negative.

e) 17 and 18 are consecutive numbers.

f) $x > 45$

g) All integers are natural numbers.

h) Some children are not fond of vegetables.

Q-2 **Given the statements P: x > y and Q: xy = 24, assign any integer values between 1 and 10 to x and y in such a way that:**

a) $P \wedge Q$ is true

b) $P \wedge Q$ is false

c) $P \vee Q$ is true

d) $P \vee Q$ is false

Q-3 **Given the statements P: 'It is raining' and Q: 'The roof is leaking', write down a simple sentence that describes each of the following logical statements.**

a) ~P

b) ~Q

c) $P \wedge Q$

d) $P \vee Q$

e) ~~Q

f) $P \Rightarrow Q$

g) $Q \Leftrightarrow P$

h) $P \Rightarrow \sim Q$

Q-4 **Construct a truth table to show that $(P \vee Q) \Rightarrow (\sim Q \Rightarrow P)$ is a tautology.**

Q-5 **Construct a truth table for each of these compound statements.**

a) $\sim P \vee Q$

b) $\sim P \wedge \sim Q$

c) $P \vee (P \Rightarrow Q)$

d) $(\sim P \wedge Q) \vee \sim Q$

Q-6 **If a shape is a square, then it is a quadrilateral.**

a) Write the statement in logical notation. Is the statement true or false?

b) Write the converse statement in logical notation and in words. Is the converse statement true or false? Give a reason for your answer.

c) Write the inverse statement in logical notation and in words. Is the inverse statement true or false? Give a reason for your answer.

d) Write the contrapositive statement in logical notation and in words. Is the contrapositive statement true or false? Give a reason for your answer.

Q-7 **If a polygon has three sides, then it is a triangle.**

a) Write the statement in logical notation. Is the statement true or false?

b) Write the converse statement in logical notation and in words. Is the converse statement true or false? Give a reason for your answer.

c) Write the inverse statement in logical notation and in words. Is the inverse statement true or false? Give a reason for your answer.

d) Write the contrapositive statement in logical notation and in words. Is the contrapositive statement true or false? Give a reason for your answer.

Q-8 **If x is a factor of 6, then x is a factor of 12.**

a) Write the statement in logical notation. Is the statement true or false?

b) Write the converse statement in logical notation and in words. Is the converse statement true or false? Give a reason for your answer.

c) Write the inverse statement in logical notation and in words. Is the inverse statement true or false? Give a reason for your answer.

d) Write the contrapositive statement in logical notation and in words. Is the contrapositive statement true or false? Give a reason for your answer.

Q-9 **If x is an even prime number, then x is 2.**

a) Write the statement in logical notation. Is the statement true or false?

b) Write the converse statement in logical notation and in words. Is the converse statement true or false? Give a reason for your answer.

c) Write the inverse statement in logical notation and in words. Is the inverse statement true or false? Give a reason for your answer.

d) Write the contrapositive statement in logical notation and in words. Is the contrapositive statement true or false? Give a reason for your answer.

Q-10 **Construct a truth table for each of the following.**

a) $P \Rightarrow Q$

b) $Q \Rightarrow P$

c) $\sim P \Rightarrow \sim Q$

d) $\sim Q \Rightarrow \sim P$

Q-11 **What do you notice about your answers to a) and d) in question 1?**

Q-12 **What do you notice about your answers to b) and c) in question 1?**

Q-13 **Use truth tables to decide whether or not each of the following pairs of statements are equivalent.**

a) $\sim(P \wedge Q)$ and $\sim P \wedge \sim Q$

b) $\sim(P \wedge Q)$ and $\sim P \vee \sim Q$

c) $\sim(P \vee Q)$ and $\sim P \vee \sim Q$

d) $\sim(P \vee Q)$ and $\sim P \wedge \sim Q$

Q-14 **Solve: Use an indirect proof (either method) to prove each of the following.**

a) The sum of two odd numbers is always an even number.

b) A triangle can have at most one right angle.

c) Every angle in an equilateral triangle is equal to 60°

Chapter-11 Topic 11 Circle geometry: Chord properties

Q-1 **Calculate length BC in ■ABC.**

Q-2 **In ■DGF, GE ■ DF and DG ■ FG. Calculate the following lengths.**

a) DG

b) EF

Q-3 **In circle centre O, OM ■ AB and M is the midpoint of AB. Calculate OM if OA = 5 cm and AB = 8 cm.**

Q-4 **DOE is a diameter of circle centre O. OM ■ DF and M is the midpoint of DF. OM = 7 cm and DF = 48 cm. Calculate the length of diameter DE.**

Q-5 **■MNP is inside circle centre O. MN = 48 mm and PN = 14 mm. Calculate the length of the radius of the circle.**

Q-6 **AB is a diameter of circle centre O. OC ■ chord DB and C is the midpoint of DB. If AD = $4\sqrt{3}$ cm and DB = 4 cm, calculate:**

a) OC

b) AB

Q-7 **■ABC is in circle centre O with AB the diameter and OM ■ AC and BC ■ AC. AO = 10 mm, AM = 6 mm and BC = 16 mm. Calculate:**

a) OM

b) AC

Q-8 **In circle centre O, ON ■ PQ.**

a) Prove that $NQ^2 = 2 \cdot ON \cdot MN$.

b) If the radius = 9 cm and OM = 1 cm, calculate NQ.

Q-9 **Given: circle with centre M and chord PR with midpoint Q.**

a) If radius MP = 5 cm and PR = 8 cm, calculate length MQ.

b) If MQ = 8 cm and QR = 15 cm, calculate the length of the radius.

c) If radius MR = 13 cm and MQ = 5 cm, calculate length PR.

Q-10 **M is the midpoint of chord AB in circle centre O. AB = 10 cm and the radius = 13 cm. Calculate the length of MP.**

Q-11 **In the circle, O is the centre and R is the midpoint of chord PQ. If PQ = 12 cm and RS = 2 cm, calculate:**

a) x

b) r

Q-12 **In circle centre O, M and N are midpoints of chords AB and CD respectively. CD = 48 mm, ON = 7 mm and OM = 5 mm. Calculate the length AB (to the nearest cm).**

Q-13 **C is the midpoint of chord AB in the circle with centre O. OC = 40 cm and AB = 80 cm. Calculate the length of the diameter (leave answer in simplified surd form).**

Q-14 **AB is a chord of circle with centre O. OP ⊥ AB and cuts AB at Q and the circle at P. If the radius is 13 cm and AQ = 12 cm, calculate:**

a) AB

b) AP (leave the answer in surd form)

Q-15 **OT = MT = TN in circle centre O. Calculate the size of ∠N.**

Q-16 **In circle centre M, CD ⊥ AB. If AB = 30 cm and CE = 5 ED, calculate:**

a) DE

b) diameter of the circle

Q-17 **In circle centre O, line OCD ⊥ AB and cuts AB at C. If chord AB = 6 cm and CD = 1 cm, find the length OC.**

Q-18 **ABC is a double chord in the circles with centres O and P. OP ■ ABC, OM ⊥ AB and PN ⊥ BC. Prove that:**

a) OPNM is a rectangle

b) OP = ½ AC

Q-19 **Two concentric circles have radii 17 cm and 25 cm. OC = 15 cm and OC ■ ABDE. Calculate the length AB.**

Q-20 **Chord AB = 80 cm and chord CD = 60 cm. OE ■ AB and OF ■ CD. The radius of the circle is 50 cm. Find the distance between the two chords.**

Q-21 **The two concentric circles with centre O have radii 5 cm and 8.5 cm. BC = 6 cm and OM ■ ABCD. Calculate the length AD.**

Q-22 **Chord AB = 30 cm and chord CD = 40 cm and AB ■ CD. OM ■ AB and ON ■ CD. If the radius of the circle is 25 cm, calculate the distance between the chords.**

Q-23 **ABC is a double chord of the circles with centres M and P. The circles intersect at B and D. Prove that AC = 2MP.**

Q-24 **MN and PQ are parallel chords in the circle with centre O. MN = 80 cm and PQ = 52 cm. The radius of the circle = 60 cm. ORS is perpendicular to chords MN and PQ. Calculate the distance between the chords. Write the answer correct to two decimal places.**

Chapter-12 Topic 12 Circle geometry: Angle properties

Q-1 **In these circles, determine the size of the angles marked a to l.**

Q-2 **Calculate, with reasons, the size of the angles marked p to s.**

Q-3 **Find the value of the angles marked x and y.**

Q-4 **Determine the value of the letters a to w in the circles below.**

Q-5 **In the circles below, determine the value of the angles named using variables.**

Q-6 **Find the size of the angles marked a, b and c in the diagram.**

Q-7 **Calculate the values of x, y and z. Give reasons throughout your calculations.**

Q-8 **Given the diagram provided.**

a) Prove that Sˆ1 = Sˆ2

b) Prove that Rˆ = 2Sˆ2

c) Show that QRST is a cyclic quadrilateral

Q-9 **In the diagram, CE || BA and Aˆ = x.**

a) Prove that ■CDE is isosceles.

b) Prove that DEOB is a cyclic quadrilateral.

Chapter-13 Topic 13 Circle geometry: Tangents

Q-1 **In circle centre O, CBD is a tangent to the circle and BC = 6 cm. OC = 10 cm. Determine the length of the diameter of the circle.**

Q-2 **Circle centre O has tangents PQ and PR. PQ = 24 cm and radius = 7 cm. Calculate the length OP.**

Q-3 **Determine the size of the angles marked a to f.**

Q-4 **In the circle, centre O, ABC is a tangent and CBˆE = 32°. Determine the size of: a) Oˆ1 b) Dˆ.**

Q-5 **In the circle centre O, ABC is a tangent and ABˆE = 48°. Determine the size of Dˆ.**

Q-6 **In the diagrams below, determine the value of the letters a to h.**

Q-7 **In each of the following, PA and PB are tangents. Calculate the value of x and y for each diagram.**

a) diagram a

b) diagram b

c) diagram c

d) diagram d

e) diagram e

Q-8 **ED is a tangent to the circle and BC = CD. Determine the size of the following angles.**

a) ∠CDE

b) ∠ABC

c) ∠BAD

Q-9 **ABC is a tangent to circle centre O. Write the following angles in terms of x.**

a) ∠BED

b) ∠ABE

c) ∠EBO

Q-10 **Given circle with centre O and tangents AB and AC, prove that ABOC is a cyclic quadrilateral.**

Q-11 **In the circle with centre O, points A, B and C are on the circumference. AB = BC and ∠BAP = 45°. Prove that AP is a tangent to the circle.**

Q-12 **DEF is a tangent to the circle. BC ■ AE, AB = BC and AE = AC.**

a) Prove that ∠ECD = x

b) Prove that ∠ABC = 180° – x

c) Write down three other angles equal to y

d) Calculate the values of x and y

Q-13 **AD is a tangent to the circle with centre O, and ∠B = 30°.**

a) Prove that ■AOC is an equilateral triangle

b) Prove that OC = CD

Q-14 **CDE is a tangent to the circle. AE ■ BD.**

a) Prove that ∠E■ = ∠B■

b) Prove that ∠D■ = ∠B■

Chapter-14 Topic 14 Trigonometry

Q-1 **Solve ■ABC if B$\hat{}$ = 50°, C$\hat{}$ = 47° and AC = 25 units.**

Q-2 **Solve ■DEF if D$\hat{}$ = 39°, DE = 3 cm and EF = 6 cm.**

Q-3 **Solve each of the triangles provided.**

a) b) c) d)

Q-4 **Solve each of the following. (Hint: Sketch a diagram of each triangle and write in the given measurements.)**

a) ∆ABC with Â = 105°, B■ = 22° and AB = 19 cm

b) ∆DEF with DE = 72 m, EF = 65 m and F■ = 58°

c) ∆JKL with J■ = 79°, K■ = 57° and KL = 5.5 units

d) ∆MNO with N■ = 124°, MN = 3 mm and MO = 8 mm

e) ∆PQR with R■ = 37.2°, Q■ = 34.5° and PR = 73 m

f) ∆XYZ with Z■ = 60.4°, XY = 7 units and YZ = 5 units

Q-5 **Find both solutions to each of the following.**

a) ∆ABC with B■ = 58°, AB = 4 cm and AC = 3.5 cm

b) ∆DEF with D■ = 76.1°, DF = 43 mm and EF = 42 mm

c) ∆JKL with K■ = 44°, JL = 50 units and KL = 65 units

d) ∆PQR with R■ = 41°, PQ = 17 m and PR = 19 m

Q-6 **In each ∆XYZ, calculate the size(s) of ■.**

a) X■ = 25°, XZ = 6.9 units and YZ = 4.8 units

b) Z■ = 45°, XY = 5 cm and XZ = √50 cm

c) X■ = 30°, XZ = 17.94 km and YZ = 8.97 km

d) Z■ = 50°, XY = 64 mm and YZ = 80 mm

Q-7 **Solve each of the triangles below.**

a)

b)

c)

d)

Q-8 **Solve each of the following with the aid of a diagram.**

a) ∆ABC with AB = 5 cm, BC = 6 cm and AC = 7 cm

b) ∆DEF with DE = 1.2 km, DF = 1.3 km and D■ = 124°

c) ∆JKL with J■ = 85°, JK = 169 units and JL = 137 units

d) ∆MNO with MN = 6 mm, NO = 4 mm and MO = 9 mm

e) ∆PQR with PQ = 301 m, PR = 473 m and QR = 338 m

f) ∆XYZ with XY = 19.5 km, YZ = 14 km and Y■ = 21.6°

Q-9 **A boy is standing at the edge of a river at point A. His friend is standing directly opposite him, on the opposite bank of the river, at point B. A third friend is swimming in the river, at point C, such that ∠AC^B = 49°, ∠ABC = 60° and AC = 45 m. Calculate the width of the river between points A and B.**

Q-10 **Two straight roads lead from Town X, with an angle of 146° between them. Two vehicles leave Town X at the same time. The average speeds of the vehicles are 80 km/h and 95 km/h respectively. After one hour, the slower vehicle has reached point Y and the faster vehicle has reached point Z. Calculate the distance between points Y and Z, correct to the nearest kilometre.**

Q-11 **Two people, M and N, leave their apartment block (A) to visit friends at the same time. They each walk along a straight road. The angle between the roads is 37°. By 20:00, person M has walked a distance of 5.2 km, and the two people are 3.25 km apart.**

a) Explain why there are two different solutions to ■MNA.

b) Sketch the complete diagram of this situation, showing both possible solutions.

c) Calculate the two possible distances that person N walked. Give your answers correct to two decimal places.

Q-12 **A parallelogram has sides of 30 mm and 90 mm. The length of the longer diagonal is 105 mm. Calculate the length of the shorter diagonal, correct to the nearest millimetre.**

Chapter-15 Topic 15 Bearings

Q-1 **The angle of depression from the top of a cliff (CF) to a swimmer (S) is 64°. The swimmer is 55 m from the base of the cliff. Calculate the height of the cliff, correct to the nearest metre.**

Q-2 **Two hikers, X and Y, are walking directly towards a vertical tower TW from opposite directions. Hiker X is 200 m from the tower and the angle of elevation from her position to the top of the tower is 32.6°. The angle of elevation from Hiker Y's position to the top of the tower is 43.5°.**

a) Calculate the height of the tower, correct to two decimal places.

b) Calculate the distance between the two hikers, correct to the nearest metre.

Q-3 **Points A, B and C are in the same vertical plane. The angle of elevation from A to C is 50° and the angle of depression from C to B is 68°. The distance from B to C is 53 cm. Calculate the distance between A and B, correct to the nearest millimetre.**

Q-4 **A girl is standing at point G watching two kites at points K and T in the same vertical plane. The angles of elevation of the girl to the kites are α and β respectively. The distances TK : GT : GK are in the ratio 2 : 3 : 4.**

a) Express $\angle$TGK in terms of α and β.

b) Use the cosine rule to prove that $\cos(\beta - \alpha) = 7/8$.

c) If the angle of elevation to the nearer kite is 70°, calculate the elevation to the other kite, correct to the nearest degree.

Q-5 **Write down the letters of the cardinal point that is directly opposite.**

a) N $\rightarrow$ ___

b) SE $\rightarrow$ ___

c) WSW $\rightarrow$ ___

d) NNE $\rightarrow$ ___

e) NE $\rightarrow$ ___

f) ESE $\rightarrow$ ___

Q-6 **Write down the letters of the cardinal point that is halfway between the given points.**

a) N and E $\rightarrow$ ___

b) NE and SE $\rightarrow$ ___

c) NW and N $\rightarrow$ ___

d) SW and NW $\rightarrow$ ___

e) SSW and WSW $\rightarrow$ ___

f) NE and S $\rightarrow$ ___

Q-7 **Write each of the following bearings in three-digit notation and in cardinal notation.**

a)

b)

Q-8 **The bearing of Q from P is 045°.**

a) Write the bearing of Q from P in cardinal notation.

b) Sketch a diagram and then calculate the bearing of P from Q. Write your answer in: (i) three-digit notation; (ii) cardinal notation

Q-9 **The bearing of D from C is S28°W.**

a) Write the bearing of D from C in three-digit notation.

b) Sketch a diagram and then calculate the bearing of C from D. Write your answer in: (i) three-digit notation; (ii) cardinal notation

Q-10 **Three cellphone towers, K, L and M, are shown in the diagram. The bearing from L to North is 015° and from L to M is 096°. The straight-line distance between L and M is 122 km, between L and K is 270 km and between K and M is 283 km. Calculate the following bearings and write your answers in cardinal notation.**

a) L from K

b) L from M

c) K from M

Q-11 **A tourist visits three towns, A, B and C. The straight-line distances from A to B and from A to C are 62 km and 73 km respectively. The bearings from A to B and from A to C are N 49° W and S 55° W respectively.**

a) Sketch a diagram of the triangle formed by these three towns. Show all the given information.

b) Calculate the bearing from B to A in three-digit notation.

c) Calculate the bearing from C to A in three-digit notation.

d) Calculate the size of $\angle BAC$.

e) Calculate the straight-line distance from B to C.

Q-12 **A triangular field is marked off by three beacons, P, Q and R, as shown in the diagram. R is due East of P and the bearing of Q from P is N 29° E. PR = 520 m and PQ = 350 m.**

a) How far apart are beacons Q and R?

b) If a land surveyor stands on the midpoint of PR, how far is she from beacon Q?

Q-13 **On the map, Lagos, Owerri and Yola form the vertices of an obtuse-angled triangle. Owerri is on a bearing of S 73.9° E from Lagos and Yola is on a bearing of N 73.7° E from Lagos. The straight-line distance from Lagos to Owerri is 412 km and from Lagos to Yola is 1 045 km.**

a) Sketch a diagram of this triangle using letters L, O and Y for the vertices and showing the North line at Lagos. Show all given information.

b) Calculate the size of $\angle$YLO.

c) Hence calculate the straight-line distance from Owerri to Yola, correct to the nearest kilometre.

Chapter-16 Topic 16 Statistics

Q-1 **For each of the following data sets, calculate the mean, median, mode and range.**

a) {3, 5, 9, 12, 17, 21, 21, 26, 33}

b) {16, 41, 2, 28, 42, 59, 52, 46, 21, 52, 41, 54, 33, 15}

c) {0.3, 8.9, –5.9, –7.7, 9.6, 5.6, 8.4, 5, 5.5, 3.9, 3.6, –7.5, –0.1}

Q-2 **A florist is delivering bunches of mixed flowers. Summarise this data in a frequency table and use your frequency table to calculate:**

a) frequency table

b) mean

c) median

d) mode

e) range

Q-3 **An English teacher challenged her class to read at least five books over the school holidays. Summarise this data in a frequency table and use your frequency table to calculate:**

a) frequency table

b) mean

c) median

d) mode

e) range

Q-4 **Copy and complete the table below by first calculating the mean and then calculating the deviation of each data value from the mean.**

Q-5 **Given the following data set: {6, 0, –3, 1, 5, 4, –4, 3}.**

a) Calculate the mean.

b) Calculate the deviation of each data value from the mean. Display your results in a table with the following headings:

Q-6 **A game warden recorded the number of baboons that she saw on ten successive days: 29, 14, 17, 25, 37, 16, 23, 28, 40, 31.**

a) Calculate the mean number of baboons.

b) Calculate the deviation of each number of baboons from the mean. Display your results in a table with the following headings:

Q-7 **Copy and complete the table below, then calculate the variance of this data.**

Q-8 **Given: the data set {2, 4, 6, 8, 10, 12}.**

a) Calculate the mean.

b) Calculate the variance of the data set. Use a table with the following headings:

Q-9 **Given: the data set {–12, –7, –2, 0, 3, 6, 9, 10, 14, 28}.**

a) Calculate the mean.

b) Calculate the variance of the data set. Use a table with the following headings:

Q-10 **Ten SS2 students were asked to make a note of the number of movies that they watched at the cinema during a given month. Their responses are listed below: 2, 4, 9, 0, 6, 3, 2, 1, 5, 0. Calculate the variance of this data. Show all your calculations.**

Q-11 **Calculate the standard deviation, correct to two decimal places, if the variance is:**

a) 1.44

b) 32.75

c) 192.68

d) 4091.03

Q-12 **Calculate the variance, correct to two decimal places, if the standard deviation is:**

a) 0.3

b) 1.09

c) 29.83

d) 508.15

Q-13 **Calculate the standard deviation of the following data sets. Write your answers in simplified surd form.**

a) {1, 2, 3, 4, 5}

b) {14, 15, 16, 17, 18}

c) {2, 4, 6, 8, 10}

d) {100, 200, 300, 400, 500}

Q-14 **Refer to your answers to question 3. What do you notice about the standard deviations of the following pairs of sets?**

a) {1, 2, 3, 4, 5} and {14, 15, 16, 17, 18}

b) {1, 2, 3, 4, 5} and {2, 4, 6, 8, 10}

c) {1, 2, 3, 4, 5} and {100, 200, 300, 400, 500}

Q-15 **Is it possible to have a data set for which the variance and standard deviation are zero? Give a reason for your answer.**

Q-16 **Is it possible to have a data set for which the variance and standard deviation are negative? Give a reason for your answer.**

Q-17 **Copy and complete the tables below by calculating the class boundaries and the midpoint for each class.**

a) Table a

b) Table b

c) Table c

Q-18 **Use the same data as in the previous example on the temperature of cooled water. Summarise the data in a frequency table using the classes (−17, −13], (−12, −8], and so on.**

Q-19 **The number of meals served daily at a school cafeteria over a period of 40 school days was as follows. Summarise this data in a frequency table using the classes 91–100, 101–110, and so on.**

Q-20 **The masses of 56 papayas (in grams) were as follows. Summarise this data in a frequency table using the classes 700–799, 800–899, and so on.**

Q-21 **The distances that some students travel every morning to get to school are as follows.**

a) Use this frequency table to estimate: (i) the mean, and (ii) the median of this data.

b) Find the modal class of this data.

c) Comment on possible values of the range for this data.

Q-22 **A speed trap was set on an open road where the speed limit was 80 km/h. Several motorists were caught exceeding the speed limit. The speeds at which these motorists were travelling are shown in the table.**

a) Use this frequency table to estimate: (i) the mean, and (ii) the median of this data.

b) Find the modal class of this data.

c) Comment on possible values of the range for this data.

Q-23 **Copy and complete the table below.**

Q-24 **Copy and complete the table below, by calculating:**

a) the midpoint of each class

b) estimating the mean of each class

c) estimating the mean deviation of each class

Q-25 **120 students sold raffle tickets to raise funds for a new piano for the school hall. Their ticket sales are summarised in the frequency table below.**

a) Estimate the mean number of tickets sold by each student.

b) Estimate the mean deviation of each class

Q-26 **Copy and complete the table below, then estimate:**

a) the variance of this data

b) the standard deviation of this data

Q-27 **Given the following frequency table, estimate:**

a) the mean of these masses

b) the variance of this data

c) the standard deviation of this data

Q-28 **A class of SS2 students estimated the area (cm^2) of their textbook covers. Their answers are summarised in the table below. Estimate:**

a) the mean of these areas

b) the variance of this data

c) the standard deviation of this data

Q-29 **A class of 45 SS2 students wrote a Science test. Their marks out of 40 are listed below. The mean of these marks is 22.6 and the standard deviation is 6.45 (correct to two decimal places).**

a) How many marks lie within one standard deviation from the mean?

b) Identify the marks that lie outside one standard deviation from the mean.

c) If the pass mark was 40%, how many students failed the test?

d) The students who failed the test complained that the test was too difficult. Do you agree? Use the given statistics to support your answer.

Q-30 **Volunteers worked at a polling station in two-hour shifts from 6 am to 6 pm. The numbers of voters (rounded to the nearest 100) who voted during each shift are shown in the table below.**

a) Estimate the variance of this data, correct to the nearest integer.

b) Estimate the standard deviation of this data, correct to the nearest integer.

c) Which shift(s) do not fall within one standard deviation from the mean?

d) Does the data suggest that the by-election took place on a normal working day, as opposed to a public holiday? Give reasons for your answer.

Q-31 **The masses of eight dogs that were weighed at an animal shelter were as follows: 5 kg, 10 kg, 12 kg, 18 kg, 21 kg, 28 kg, 40 kg and 54 kg.**

a) Calculate the mean, variance and the standard deviation of these masses.

b) How many of these masses fall within one standard deviation from the mean?

Q-32 **A class of Primary School Mathematics students worked in groups of five as they measured the same angle and compared their measurements.**

a) The standard deviation of the measurements of one group was 0°. How is this possible?

b) Another group was measuring an angle of 60°, but their mean measurement was 72°. Suggest what might have happened in this case. (Hint: Think about the sum of the five measurements.)

Q-33 **Say whether or not each of the following sets of data is suitable for representation in a histogram. Give a reason each time.**

a) number of items in the pencil cases of a class of students

b) maximum daily temperatures for a month

c) favourite colours of a group of friends

d) marks scored by a class in a Mathematics exam

e) heights of out-patients at a clinic

Q-34 **The masses and heights of some Nigerian dwarf goats are summarised in the tables below.**

a) How many goats are represented in each table?

b) Display the masses of these goats in a histogram.

c) Display the heights of these goats in a separate histogram.

Q-35 **A small village has a population of 500 people. Their ages are given in this frequency table. Copy and complete the table by calculating the cumulative frequencies.**

Q-36 **Draw up a new cumulative frequency table for the data in question 1, but use these class intervals: 0–20, 21–40, and so on.**

Q-37 **Copy and complete the table and represent the cumulative frequencies in an ogive.**

Q-38 **Students were asked to collect items to bring to school for recycling. The ogive below shows the results of this recycling effort.**

a) How many students took part in this recycling effort?

b) What was the maximum number of items that any one student brought to school?

c) Estimate Q2

d) Estimate Q1

e) Estimate Q3

f) If a student brought eight items to school for recycling, between which two quartiles will that student fall?

Q-39 **The manager of a large taxi company analysed the distances that his taxis covered during one week. He presented his data in the ogive below.**

a) How many taxis operated during that week?

b) What was the maximum distance that any one taxi covered?

Q-40 **Use the ogive from the previous example to answer the following questions.**

a) Estimate the value of P75 (the 75th percentile).

b) Into which percentile does a patient with a BMI of 31 fall?

Q-41 **For a project on Statistics, a student interviewed 160 students in her school to find out how long it took them on average to get to school every morning. She rounded the answers off to the nearest minute and presented her data in this ogive.**

a) Estimate the values (to the nearest minute) of: (i) P10 (ii) P30 (iii) P50 (iv) P90

b) Name two other measures of dispersion that are equivalent to P50.

c) What does the value of P50 tell us in this situation?

d) If a student takes half an hour to get to school, into which percentile does he or she fall?

Chapter-17 Topic 17 Probability

Q-1 **Shalewa tossed a coin five times. She got three heads and two tails. In question 1 write all probabilities as common fractions.**

a) How many different possible outcomes are there when tossing a coin?

b) How many trials took place?

c) What is the theoretical probability of getting heads when you toss a coin?

d) What was the relative frequency (experimental probability) of getting heads in Shalewa's experiment?

Q-2 **Bello rolled a die 10 times. He got these results: 2, 3, 3, 2, 5, 6, 4, 2, 3, 4. In question 2 write all probabilities as common fractions.**

a) How many different possible outcomes are there when rolling a die?

b) How many trials took place?

c) What is the theoretical probability of getting a 2 when you roll a die?

d) What was the relative frequency of getting a 2 in Bello's experiment?

e) What is the theoretical probability of getting a 1 when you roll a die?

f) What was the relative frequency of getting a 1 in Bello's experiment?

g) What is the theoretical probability of getting a 2 or a 3 when you roll a die?

Q-3 **A group of friends played a game in which they took turns to draw a card from a standard pack of playing cards. After each draw they replaced the card and shuffled. The cards drawn were: 8♥, A♥, J♣, 4♣, 3♣, Q♥, K♦, 8♥, 2♥, 7♠, A♥, 10♥. In question 3 write all probabilities as decimal numbers, correct to two decimal places.**

a) How many different possible outcomes are there when a card is chosen from a standard pack of playing cards?

b) How many trials took place?

c) What is the theoretical probability of choosing a red card?

d) What was the relative frequency of choosing a red card in this experiment?

e) What is the theoretical probability of choosing a diamond?

f) What was the relative frequency of choosing a diamond in this experiment?

g) What is the theoretical probability of choosing a number card?

Q-4 **Two dice are rolled.**

a) Use a two-way table to show all the possible outcomes in this sample space.

b) Explain how to find all the outcomes of which the numbers on both dice are the same.

c) Explain how to find all the outcomes of which the sum of the numbers on the dice is 7.

Q-5 **List the sample space to show all the possible outcomes of tossing three coins. Use H for heads and T for tails.**

Q-6 **A basket contains one red ball (R), one yellow ball (Y), one orange ball (O), one green ball (G) and one blue ball (B). One ball is taken out of the basket, its colour is noted and it is returned to the bag. Then a second ball is taken out of the basket. Use a two-way table to show all the possible outcomes in this sample space.**

Q-7 **Sumbo is packing her school lunch. She can take one fruit juice and one sandwich. She can choose between orange juice (O) and peach juice (P). On her sandwich, she can put cheese (C), meat (M) or jam (J). List the sample space to show all the possible combinations that she can pack for her lunch.**

Q-8 **Bisi has a ■2 coin, two ■1 coins and a 50 kobo coin in her pocket. She takes two coins out of her pocket at random. List the sample space to show all the possible outcomes in this situation.**

Q-9 **Solve:**

a) Copy and complete the table.

b) One of you should toss a coin 20 times. Every time the coin comes up heads, your partner should make a note of this. Once you have tossed the coin 20 times, your partner writes the total number of heads in the second column of the table.

c) Swap roles and repeat step b). Conduct this experiment five times altogether. You should have five numbers in the second column of the table.

d) Complete the fourth column of the table. The first row will be the number of heads that you got in the first experiment. The second row will be the number of heads that you got in the first two experiments, and so on. The last row will be the number of heads that you got in all five experiments.

e) Complete the last column of the table by dividing the total number of heads in each row by the total number of tosses in that row. Write your answer as a decimal fraction, correct to two decimal places.

f) Do you agree that the probability of getting heads when you toss a coin is ½? Write this as a decimal number.

g) What do you notice about the numbers in the last column of your table? Write a sentence or two describing what you see.

Q-10 **Solve:**

a) Copy and complete the table.

b) One of you should roll a die 20 times. Every time you roll a 6, your partner should make a note of this. Once you have rolled the die 20 times, write the total number of 6s in the second column of the table.

c) Swap roles and repeat step b). Conduct this experiment five times altogether. You should have five numbers in the second column of the table.

d) Complete the fourth column of the table. The first row will be the number of 6s that you got in the first experiment. The second row will be the number of 6s that you got in the first two experiments, and so on. The last row will be the number of 6s that you got in all five experiments.

e) Complete the last column of the table by dividing the total number of 6s in each row by the total number of rolls in that row. Write your answer as a decimal fraction, correct to two decimal places.

f) Do you agree that the probability of getting a 6 when you roll a die is 1/6? Write this as a decimal number.

g) What do you notice about the numbers in the last column of your table? Write a sentence or two describing what you see.

Q-11 **Calculate P(A′) if P(A) is:**

a) 0.74

b) 1/4

c) 11/50

d) 1

Q-12 **Calculate P(B) if P(B′) is:**

a) 0

b) 6/25

c) 1/10

d) 0.59

Q-13 **A card is chosen randomly from a well-shuffled pack of playing cards (with no Jokers).**

a) What is the probability of choosing an Ace?

b) What is the probability of choosing a card that is not an Ace?

c) What is the probability of choosing a black court card?

d) What is the probability of choosing a card that is not a black court card?

Q-14 **A die is rolled.**

a) Calculate the probability of getting an odd number.

b) Calculate the probability of getting a number less than 4.

c) Look at your answers to questions a) and b). You should have found that P(getting an odd number) + P(getting a number less than 4) = 1. Does this mean that 'getting an odd number' and 'getting a number less than 4' are complementary events? Give a reason for your answer.

Q-15 **In each of the following experiments, say whether or not the events A and B are mutually exclusive.**

a) Experiment: A number from 1 to 100 is chosen at random. Event A: choosing an odd number. Event B: choosing an even number.

b) Experiment: A number between 200 and 500 is chosen at random. Event A: choosing a number between 200 and 400. Event B: choosing a number between 300 and 500.

c) Experiment: A student from an SS2 class is chosen at random. Event A: choosing a girl. Event B: choosing a boy.

d) Experiment: A student from an SS2 class is chosen at random. Event A: choosing a student whose first name begins with an A. Event B: choosing a student whose last name begins with a T.

Q-16 **A family is planning where to go on their holidays. They have only one week, so they can only go to one destination. They have the following four options and the probability that they will go to each is given in brackets: Enugu (15%), Makurdi (25%), Beli (20%) and Lokoja (40%). Calculate the probability of each of the following.**

a) They will go to Enugu or Makurdi.

b) They will go to Beli or Lokoja.

c) They will not go to Enugu.

Q-17 **A school held a raffle to raise money for new sports equipment. The prize was an off-road bicycle. The school sold 4 000 tickets in total. Bisola bought 25 tickets and Kole bought 40 tickets.**

a) Explain why the events (Bisola wins the prize) and (Kole wins the prize) are mutually exclusive.

b) Calculate the probability of each of the following. i) Bisola will win the prize. ii) Kole will win the prize. iii) Bisola or Kole will win the prize. iv) Neither Bisola nor Kole will win the prize.

Q-18 **An SS2 class must choose a class captain. The following students have been nominated: Adesoji, Muyiwa, Adedolapo, Funmilola, Modupe, Ademola, Folorunso and Ajibade. The class captain will be chosen at random from these students. Calculate the probability that the name of the student who is chosen begins with:**

a) an A

b) an F

c) an M

d) an A or an F

e) an F or an M

Q-19 **A weather forecaster noted the maximum temperatures in a certain region during a given month. The relative frequencies of the following maximum temperatures are listed in the table that follows.**

Q-20 **Say whether or not the events A and B are independent in each of the following pairs of events.**

a) Event A: choosing an odd number between 1 and 100; Event B: choosing an even number between 1 and 100

b) Event A: choosing a team member to be the team captain; Event B: choosing a different team member to be the vice-captain

c) Event A: choosing a number between 200 and 500; Event B: choosing a different number between 200 and 500

d) Event A: choosing a library book; Event B: choosing a chapter of that book

e) Event A: choosing a friend to invite to the movies; Event B: choosing another friend to invite to the movies

f) Event A: choosing a letter of the alphabet; Event B: choosing a colour

Q-21 **You toss a coin, roll a die and pick a card from a pack of cards (with no Jokers). Write the probability of each of the following outcomes as a fraction in its simplest form.**

a) heads, an odd number and a red card

b) heads, a number greater than 4 and a court card (Jack, Queen or King)

c) tails, a 5 and an Ace

Q-22 **A two-digit number is formed as follows: the first digit is chosen at random from {7, 8, 9} and the second digit is chosen at random from {0, 4, 7}.**

a) Write down all possible numbers that can be formed in this way.

b) Calculate the probability that the number will be: (i) even; (ii) a multiple of 5; (iii) a multiple of 11; (iv) greater than 80; (v) less than 79

Q-23 **A ball is chosen at random from a basket that contains only red and green balls. The probability of choosing a red ball is 5/7. Let A be the event 'choosing a red ball' and B be the event 'choosing a green ball'.**

a) Explain why events A and B are complementary.

b) What is the probability of choosing a green ball?

c) If there are 8 green balls in the bag, how many balls are there altogether?

Q-24 **In each of the following, say whether or not events A and B are independent, mutually exclusive or neither. Show all your calculations.**

a) P(A) = 0.6, P(B) = 0.3 and P(A and B) = 0.18

b) P(A) = 0.2, P(B) = 0.9 and P(A and B) = 0.6

c) P(A) = 0.1, P(B) = 0.75 and P(A or B) = 0.7

d) P(A) = 0.45, P(B) = 0.25 and P(A or B) = 0.7

Q-25 **Three dice are rolled.**

a) What is the probability of getting three 6s?

b) What is the probability of getting anything other than three 6s?

h) What was the relative frequency of choosing a number card?

i) What is the theoretical probability of choosing a court card?

j) What was the relative frequency of choosing a court card?

k) What is the theoretical probability of choosing the Ace of hearts?

l) What was the relative frequency of choosing the Ace of hearts?

m) What is the theoretical probability of choosing a 5?

n) What was the relative frequency of choosing a 5?

Q-26 **A two-digit number is formed as follows: the first digit is chosen at random from {7, 8, 9} and the second digit is chosen at random from {0, 4, 7}.**

a) Are these two events (choosing the ten's digit) and (choosing the unit's digit) independent? Give a reason for your answer.

b) Write down all possible numbers that can be formed in this way.

c) Calculate the probability that the number will be even.

d) Calculate the probability that the number will be a multiple of 5.

e) Calculate the probability that the number will be a multiple of 11.

f) Calculate the probability that the number will be greater than 80.

g) Calculate the probability that the number will be less than 79.

Q-27 **A simple pin code consists of a letter of the alphabet followed by a digit.**

a) How many different pin codes can be formed in this way?

b) What is the probability that a pin code, chosen at random, consists of a vowel followed by an even number?

Q-28 **The probability that Yomi scores in a football match is 3/4, the probability that Dele scores is 2/3 and the probability that Segun scores is 3/5.**

a) P(all three players score)

b) P(Dele scores but Segun does not)

c) P(only Yomi scores)

d) P(none of them scores)

Q-29 **In a school cafeteria, the probability that rice will be served for lunch on any given school day is 3/5, the probability that beans will be served is 1/4, and the probability that both will be served is 3/20. Let A be the event that rice will be served and B be the event that beans will be served.**

a) Are A and B mutually exclusive events? Give a reason for your answer.

b) Are A and B independent events? Give a reason for your answer.

c) Determine the probability that: i) rice will be served, but beans will not; ii) beans will be served, but rice will not; iii) neither rice nor beans will be served.

Q-30 **In a chess tournament, Bolaji is playing against Ikeade, Sade is playing against Tola and Habib is playing against Femi. Assume that no draws will take place. The probability that Bolaji will beat Ikeade is 1/4. The probability that Sade will beat Tola is 2/3. The probability that Habib will beat Femi is 3/10.**

a) Are the following pairs of events independent, mutually exclusive, or none of the above? Give a reason to support your answer. i) Event A: Bolaji wins; Event B: Ikeade wins. ii) Event A: Sade wins; Event B: Habib wins.

b) Calculate each of the following probabilities. i) Bolaji, Sade and Habib all win. ii) Bolaji, Sade and Habib all lose. iii) Bolaji and Sade win, but Habib loses.

Q-31 **Sola and Saheed have a bag that contains one red marble (R), one blue marble (B), one green marble (G) and one yellow marble (Y).**

a) Sola takes one marble out of the bag and then puts it back. Saheed shakes the bag well and then takes one marble out of the bag and then puts it back. (i) List all the possible outcomes in this situation. (ii) How many possible outcomes are there in this situation?

b) Saheed takes one marble out of the bag but does not put it back. Sola takes one marble out of the bag. (i) List all the possible outcomes in this situation. (ii) How many possible outcomes are there in this situation?

c) Wumi joins the game. Each child takes one marble out of the bag but does not put it back. (i) List all the possible outcomes in this situation. (ii) How many possible outcomes are there in this situation?

Q-32 **A basket contains two red, four blue and five white balls.**

a) Three balls are taken out of the basket with replacement. What is the probability of getting: (i) three balls of the same colour (ii) three balls of different colours (iii) at least one red ball?

b) Three balls are taken out of the basket without replacement. What is the probability of getting: (i) three balls of the same colour (ii) three balls of different colours (iii) at least one red ball?

Q-33 **Taiwo is choosing a password for a computer game. The password must be of the form @@@###, where @ is a letter of the alphabet, and # is a digit.**

a) How many different passwords can he make if he may use any letter or digit more than once?

b) If he may use any letter or digit more than once and he chooses a password at random, what is the probability that his password starts with an A and ends with a 9?

c) How many different passwords can he make if he may not use any letter or digit more than once?

d) If he may not use any letter or digit more than once and he chooses a password at random, what is the probability that his password starts with an A and ends with a 9?

Q-34 **The infant mortality rates for Nigeria for the years from 2010 to 2013 are listed in the table below. This means that in 2010 there were 82 infant deaths for every 1 000 live births in Nigeria.**

a) What do you notice about the trend in the infant mortality rates for the years from 2010 to 2013?

b) What was the probability that a baby born alive in 2011 did not survive?

c) A couple had a baby in 2010 and another in 2013: (i) Calculate the probability that both babies were born alive but did not survive. (ii) Calculate the probability that both babies were born alive and survived.

Q-35 **An investor has a lump sum of money to invest and he decides to invest half of his money in each of two shares on the capital market (stock exchange), X and Y. The expected performance of each share is listed in the table on the next page.**

a) Assuming that each share will perform independently of the other, calculate: (i) the probability that the investor will receive high dividends from both shares; (ii) medium dividends from both shares; (iii) low dividends from both shares; (iv) no dividends from both shares.

b) Calculate the sum of your answers in a). Explain clearly why this sum is not equal to 1.

Q-36 **Seven men and five women took part in an 'Esusu' savings scheme. At the end of the first year, a random draw was held to determine which person would receive the first dividend. Let M be the event that a man's name was drawn and W be the event that a woman's name was drawn.**

a) Are M and W complementary, mutually exclusive or independent events? Give reasons for your answer.

b) Calculate the probability that a woman's name was drawn. Write your answer correct to two decimal places.

Q-37 **The population of a small village consisted of 162 men, 185 women, 259 boys and 214 girls.**

a) What was the size of the total population?

b) If one person was chosen at random from the village, calculate (i) the probability that the person was a man, (ii) a girl, (iii) an adult, (iv) a female. Write each probability correct to two decimal places.

Q-38 **A mountain pass has been divided into four sections (A to D) for the purpose of analysis. Over the years 2011 to 2013, the number of accidents that occurred on the pass was recorded as follows.**

a) Copy and complete the table.

b) Calculate the probability that a random accident over the three-year period occurred in each of the four sections. Write your answers as percentages, correct to one decimal place.

c) Which section of the pass is most urgently in need of attention with a view to making it safer? Give a reason for your answer.

Q-39 **The manager of a football team is planning to hire a goalkeeper. He is considering three players, Damola, Wole and Gbenga, for this position. During the past season, the probability that each goalkeeper saved any given penalty was as follows: Damola – 2/5, Wole – 1/3 and Gbenga – 11/30.**

a) Express each player's success rate as a decimal number, correct to two decimal places.

b) Based only on this information, which player is most successful as a goalkeeper?

c) Do you think that the team manager should also take into account the number of penalties that each goalkeeper faced? Give reasons for your answer.

d) To gather more data before making a final decision, the manager tested the players with 150 penalties each. How many of these penalties would you expect each goalkeeper to save?

Q-40 **The probability that a woman who is tested for breast cancer at a certain hospital tests positive is 5%. Of the positive tests, 8.5% are falsely positive.**

a) Calculate the probability that a woman who is tested at the hospital actually has breast cancer.

b) If 3 000 women were tested at the hospital during one year, estimate how many women: (i) tested positive; (ii) actually had breast cancer.

Q-41 **A survey amongst a sample of 250 students revealed the following information: 55 had already visited a neighbouring country; 31 were planning to study Science at a tertiary level; 152 expected to be married before the age of 30; 198 hoped to have at least three children.**

a) Calculate the experimental probability that a student chosen at random: (i) had visited a neighbouring country; (ii) was planning to study Science at a tertiary level; (iii) expected to be married before the age of 30; (iv) hoped to have at least three children.

b) If the population from which the sample was chosen consisted of 40 000 students, predict the number of students in the population that: (i) have visited a neighbouring country; (ii) are planning to study Science at a tertiary level; (iii) expect to be married before the age of 30; (iv) hope to have at least three children.