Question bank

Chapter-1 Topic 1 Revision

Q-1 **Convert each binary number to a decimal number**

a) 101■

b) 10 110■

Q-2 **Convert each decimal number to a binary number**

a) 25■■

b) 83■■

Q-3 **Convert each number to a decimal number**

a) 20■■

b) 3 120■

c) 3 412■

d) 67 ■■

Q-4 **Convert 137■■ to each of the following bases**

a) base 3

b) base 4

c) base 5

d) base 8

Q-5 **The relationship between speed, distance and time is shown in these diagrams: Distance = Speed × Time**

a) If a motorist travels at a constant speed, what kind of proportionality is there between distance and time? Give a reason for your answer.

b) If a motorist has to cover a given distance, what kind of proportionality is there between time and speed? Give a reason for your answer.

Q-6 **Each student in an SS1 class has been asked to bring five items to school for recycling. Let x be the number of students who each bring five items to school and y be the total number of items.**

a) Write an equation to express y in terms of x.

b) What kind of proportionality is there between x and y?

c) What is the constant of proportionality in this case?

Q-7 **The students in an SS1 class have been asked to raise funds for a fan for their classroom. The fan will cost ■12 000. Let x be the number of students who are prepared to take part in this fund-raising event and let y be the amount of money that each student must raise.**

a) Write an equation to express y in terms of x.

b) What kind of proportionality is there between x and y?

c) What is the constant of proportionality in this case?

Q-8 **Write down the reciprocal of each number.**

a) 4/5

b) 1/6

c) –5/13

d) 17/2

e) 3

f) –0.25

Q-9 **If a given amount earns simple interest at a fixed interest rate, what kind of proportionality is there between SI and n? Give a reason for your answer.**

Q-10 **Jire wants to invest ■500 000 for 6 years. Bank A offers her 9% simple interest p.a., while Bank B offers her 8.5% compound interest p.a.**

a) How much interest will Jire's investment earn if she invests her money in Bank A?

b) How much interest will Jire's investment earn if she invests her money in Bank B?

c) Which option should Jire choose? Give a reason for your answer.

Q-11 **If Jire was borrowing the money at the same rates as stated in question 2, which option should she choose? Give a reason for your answer.**

Q-12 **If the value of a tractor depreciates by 12.5% p.a., how many years will it take for the value of the tractor to halve? (Hint: trial-and-improvement.)**

Q-13 **If 1 ■ of milk costs ■400 and the inflation rate is constant at 8.5% p.a., what will 1 ■ of milk cost in 10 years' time?**

Q-14 **Say if each number is rational or irrational. Give a reason for your answer.**

a) 22/7

b) –0.25

c) π

d) $\sqrt{(4/9)}$

e) 0

f) 0.6■

g) –4/9

h) 1.092

i) $\sqrt{144}$

j) $\sqrt{(5/2)}$

Q-15 **Tunde constructed a circle with a radius of 6 cm. He measured the circumference of the circle and found it to be 37.7 cm, correct to the nearest millimetre. From this he deduced that the value of π must be 3.1416.**

a) Explain, by calculation, how Tunde arrived at the number of 3.1416 for π.

b) As a result of this experiment, Tunde claims that π is a rational number. What is the flaw in his argument?

Q-16 **Factorise each expression.**

a) $36x^3 – 9y^2 + 18xy$

b) $2x^2 – 200$

c) $–6x + 16 – x^2$

d) $x – y – ay + ax$

e) $3x^3y^2 – 6xy^2$

f) $a(x – 1) – b(x – 1) + c(1 – x)$

g) $x^2 – 7x – 60$

h) $2x^2 + 14x – 36$

i) $25x^2 – 81y^2$

j) $2x^2 + xy – 8xy – 4y^2$

Q-17 **Without using a calculator, evaluate the following: $57^2 – 53^2$**

Q-18 **Solve for x.**

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

b) $5 – x/3 = x/2$

c) $(5x – 1)/3 = (x + 4)/4$

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

e) $1 - \frac{1}{2}(x + 3) = \frac{3}{4}(2x - 1)$

f) $6 = 18/(4 - x)$

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

h) $(2x - 4)/(x + 1) = (2x + 1)/(x + 2)$

Q-19 **Make h the subject of the formula V = l b h.**

Q-20 **Make r the subject of the formula C = 2 π r.**

Q-21 **Make P the subject of the formula A = P (1 + r/100)^n.**

Q-22 **Make b the subject of the formula A = 2 (l h + l b + b h).**

Q-23 **Make s the subject of the formula $V = s^3$.**

Q-24 **Make b■ the subject of the formula A = ½ h (b■ + b■).**

Q-25 **Make a the subject of the formula S = (n/2) [2 a + (n – 1) d].**

Q-26 **Use elimination to solve for x and y in each pair of equations.**

a) $y - x = 1$ and $x + y = -35$

b) $y - x = 5$ and $y - 2x = 0$

c) $3x + 5y = 11$ and $4x - 3y = 34$

Q-27 **Use substitution to solve for x and y in each pair of equations.**

a) $x + y = 3$ and $y = x + 1$

b) $x = y + 3$ and $x + y = 13$

c) $x = -y$ and $x - y = 10$

Q-28 **Use any method that you like to solve for x and y in each pair of equations.**

a) $x = y - 2$ and $x + y = 8$

b) $y = 1 - x$ and $y = -2x + 7/4$

c) $x + y = 0.6$ and $y = -4x$

d) $y = 5/4\ x$ and $x + y = 1$

e) $y = 1 - x$ and $y = 3x + 1/5$

f) $x + y = -0.125$ and $y = -1.5x$

Q-29 **Use the trigonometric tables on pages 286 to 291 or a calculator to calculate each of the following, correct to two decimal places.**

a) sin 33°

b) cos 15.6°

c) tan 88.2°

d) sin 67.3°

Q-30 **Use the trigonometric tables or a calculator to calculate the value of θ in each of the following, correct to one decimal place.**

a) $\cos \theta = 0.93$

b) $\tan \theta = 1.6$

c) $\sin \theta = 0.69$

d) $\cos \theta = 0.27$

Q-31 **In the diagram below, a hiker is standing at point H, 70 m from the base of a vertical cliff MN. She spots a monkey sitting on the edge of the cliff at point M. The angle of elevation from the hiker to the monkey is 35.5°. She then walks a distance of 25 m in a straight line towards the base of the cliff. The angle of elevation from this new point, K, to the monkey is θ.**

a) Calculate the height of the cliff (MN), correct to the nearest metre.

b) Calculate the size of angle θ, correct to the nearest degree.

c) Use your answer to questions a) and b) to calculate the straight-line distance KM, correct to the nearest metre.

Q-32 **The bearing of point B from point A is 113°. Draw a rough sketch and calculate the bearing of point A from point B.**

Q-33 **Sumbo constructed a circle with a radius of 15 cm and then shaded a sector of the circle, with an angle of 75° at the centre. Calculate each of the following, correct to two decimal places.**

a) the circumference of the whole circle

b) the area of the whole circle

c) the circumference of the shaded sector

d) the area of the shaded sector

Q-34 **A traffic warden counted the number of people in vehicles passing by. She summarised her data in this frequency table.**

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

b) How many vehicles are represented in the frequency table?

c) How many people are represented in the frequency table?

d) Draw a bar graph of the data in the frequency table.

Q-35 **The manager at a hotel in Lagos made a list of the foreign guests who were booked into the hotel for the weekend. He wanted to represent this data in a pie chart. He started off doing his calculations in the table below.**

a) Check the manager's calculations of the percentages. Note that he has rounded the percentages off to the nearest whole number.

b) Check his calculations of the sector angle for the French tourists. Note that he has rounded the angle off to the nearest whole number.

c) Calculate the angles for each of the other sectors.

d) Calculate the total for all the angles. Does your total equal 360°? If not, check your calculations again.

e) Draw a pie chart of this data. Write the name of each nationality inside its sector.

Q-36 **Find i) the mean, ii) the median, iii) the mode and iv) the range of each of these data sets.**

a) 3, 3, 4, 3, 5, 5, 2, 4, 7

b) 4, 26, 2, 25, 13, 27, 12, 13, 2, 11

c) –23, –21, 9, –30, –40, 38, –34, 20, –14, 28, –32

Q-37 **Find all the data values in the data set for which you are given the following clues: There are five data values in the data set. The median is 9. The mode is 6. The range is 12. The mean is 11.**

Chapter-2 Topic 2 Number base systems

Q-1 **Write each of the following numbers in expanded notation, using powers of 10.**

a) 169

b) 9 028

c) 28 003

d) 405 291

Q-2 **Write each of the following expanded numbers in decimal form.**

a) $6 \times 10^3 + 4 \times 10^2 + 7 \times 10^1 + 3 \times 10$■

b) 4×10■ $+ 3 \times 10^3 + 2 \times 10^2 + 1 \times 10^1$

c) 9×10■ $+ 2 \times 10$■ $+ 6 \times 10^3 + 8 \times 10^1 + 5 \times 10$■

d) $7 \times 10^{■} + 2 \times 10^{■} + 8 \times 10^{2}$

Q-3 **Convert each of the following base 4 numbers to base 10.**

a) $23_{■}$

b) $120_{■}$

c) $2103_{■}$

d) $31211_{■}$

Q-4 **Convert each of the following base 10 numbers to base 4.**

a) 15

b) 64

c) 396

d) 2781

Q-5 **Convert each of the following base 5 numbers to base 10.**

a) $42_{■}$

b) $130_{■}$

c) $432_{■}$

d) $3103_{■}$

Q-6 **Convert each of the following base 10 numbers to base 5.**

a) 25

b) 60

c) 492

d) 9028

Q-7 **Convert each of the following base 8 numbers to base 10.**

a) $63_{■}$

b) $215_{■}$

c) $774_{■}$

d) $3560_{■}$

Q-8 **Convert each of the following base 10 numbers to base 8.**

a) 64

b) 189

c) 3802

d) 12983

Q-9 **Convert each of the following base 16 numbers to base 10.**

a) 39■■

b) 2A6■■

c) D8E■■

d) BC04■■

Q-10 **Convert each of the following base 10 numbers to base 16.**

a) 17

b) 529

c) 4444

d) 11626

Q-11 **Convert each of the following base 2 numbers to base 10.**

a) 111■

b) 1 110■

c) 10 111■

d) 101 101■

e) 110 001■

f) 1 001 010■

g) 11 011 111■

h) 1 001 110 011■

Q-12 **Convert each of the following bicimals to decimals.**

a) 0.1■

b) 1.01■

c) 10.011■

d) 11.1011■

e) 101.00001■

f) 111.01011■

g) 1010.01101■

h) 1011.110011■

Q-13 **Convert each of the following fractions to decimals. Round your answers off to four decimal places, where necessary.**

a) 3.2■

b) 12.03■

c) 4.21■

d) 31.413■

e) 5.73■

f) 24.064■

g) 9.E8■■

h) 1C.8A■■

Q-14 **Convert 32 310■ to:**

a) base 5

b) base 8

c) base 16

Q-15 **Convert 2 041■ to:**

a) base 4

b) base 8

c) base 16

Q-16 **Convert 5 720■ to:**

a) base 4

b) base 5

c) base 16

Q-17 **Convert CE8■■ to:**

a) base 4

b) base 5

c) base 8

Q-18 **Do the following additions.**

a) 201■ + 131■

b) 233■ + 102■

c) 234■ + 210■

d) 1043■ + 324■

e) 571■ + 104■

f) 1205■ + 736■

g) 27D■■ + 421■■

h) 3AC■■ + 546■■

Q-19 **Do the following subtractions.**

a) 333■ – 132■

b) 311■ – 123■

c) 2413■ – 1303■

d) 342■ – 230■

e) 764■ – 324■

f) 5107■ – 264■

g) 1E9■■ – 1D8■■

h) C23■■ – A0C■■

Q-20 **Do the following multiplications.**

a) 321■ × 20■

b) 230■ × 101■

c) 342■ × 4■

d) 1423■ × 12■

e) 65■ × 14■

f) 501■ × 33■

g) 20B■■ × C■■

h) 1DF■■ × 21■■

Q-21 **Do the following divisions.**

a) 123■ ÷ 3■

b) 231■ ÷ 21■

c) 341■ ÷ 4■

d) 510■ ÷ 111■

e) 102■ ÷ 20■

f) 245■ ÷ 17■

g) 8C■■ ÷ 4■■

h) 58D■■ ÷ 31■■

Q-22 **Translate each of the 16 bit strings below into octal (base 8).**

a) 0110100011001111

b) 1101110000010001

c) 1010011001111011

Q-23 **Why do you think it can be more convenient to represent data in octal or hexadecimal than in binary?**

Q-24 **Use this table of ASCII code to find the missing words in the sentences below**

a) Computer equipment is called 110101122104127101122105 (base 8).

b) Programs and data are called 534F465457415245 (base 16).

c) Information stored on a computer is called 104101124101 (base 8).

d) To enter data into a computer, you can use a 4B4559424F415244 (base 16).

e) To display data that is in a computer, you can use a 123103122105105116 (base 8) or a 5052494E544552 (base 16).

Chapter-3 Topic 3 Modular arithmetic

Q-1 **Write down the residues of each of the following.**

a) mod 2

b) mod 4

c) mod 5

d) mod 12

Q-2 **Complete each of the following statements.**

a) 3 = … mod 2

b) 9 = … mod 7

c) 12 = … mod 8

d) 15 = … mod 5

e) 16 = … mod 3

f) 19 = … mod 4

g) 49 = … mod 3

h) 34 = … mod 6

i) 20 = … mod 7

j) 29 = … mod 9

k) 34 = … mod 12

l) 58 = … mod 10

Q-3 **Complete each of the following statements.**

a) –3 = … mod 2

b) –9 = … mod 7

c) –12 = … mod 8

d) –15 = … mod 5

e) –16 = … mod 3

f) –19 = … mod 4

g) –49 = … mod 3

h) –34 = … mod 6

i) –20 = … mod 7

j) –29 = … mod 9

k) –34 = … mod 12

l) –58 = … mod 10

Q-4 **Do each of the following additions in the given modulus.**

a) 8 ⊕ 2 (mod 3)

b) 6 ⊕ 15 (mod 8)

c) 12 ⊕ 23 (mod 5)

d) 34 ⊕ 12 (mod 6)

e) 41 ⊕ 20 (mod 9)

f) 18 ⊕ 8 (mod 12)

g) 5 ⊕ 31 (mod 10)

h) 12 ⊕ 15 (mod 4)

i) 16 ⊕ 8 (mod 7)

j) 33 ⊕ 21 (mod 11)

Q-5 **Do each of the following additions in the given modulus.**

a) 2 ⊕ 8 (mod 3)

b) 15 ⊕ 6 (mod 8)

c) 23 ⊕ 12 (mod 5)

d) 12 ⊕ 34 (mod 6)

e) 20 ⊕ 41 (mod 9)

f) 8 ⊕ 18 (mod 12)

g) 31 ⊕ 5 (mod 10)

h) 15 ⊕ 12 (mod 4)

i) 8 ⊕ 16 (mod 7)

j) 21 ⊕ 33 (mod 11)

Q-6 **Look carefully at your answers to questions 1 and 2.**

a) Compare the questions and answers in questions 1a) and 2a), 1b) and 2b) and so on. What do you notice?

b) Is a ⊕ b (mod n) = b ⊕ a (mod n)? Give a reason for your answer.

Q-7 **Do each of the following subtractions in the given modulus.**

a) 12 ■ 6 (mod 10)

b) 25 ■ 9 (mod 3)

c) 17 ■ 42 (mod 4)

d) 38 ■ 6 (mod 8)

e) 61 ■ 37 (mod 11)

f) 11 ■ 34 (mod 7)

g) 52 ■ 23 (mod 6)

h) 99 ■ 40 (mod 5)

i) 42 ■ 29 (mod 9)

j) 28 ■ 19 (mod 12)

Q-8 **Do each of the following subtractions in the given modulus.**

a) 6 ■ 12 (mod 10)

b) 9 ■ 25 (mod 3)

c) 42 ■ 17 (mod 4)

d) 6 ■ 38 (mod 8)

e) 37 ■ 61 (mod 11)

f) 34 ■ 11 (mod 7)

g) 23 ■ 52 (mod 6)

h) 40 ■ 99 (mod 5)

i) 29 ■ 42 (mod 9)

j) 19 ■ 28 (mod 12)

Q-9 **Look carefully at your answers to questions 1 and 2.**

a) Compare the questions and answers in questions 1a) and 2a), 1b) and 2b) and so on. What do you notice?

b) Is a ■ b (mod n) = b ■ a (mod n)? Give a reason for your answer.

Q-10 **Do each of the following multiplications in the given modulus.**

a) 11 ⊗ 5 (mod 4)

b) 6 ⊗ 9 (mod 7)

c) –3 ⊗ –8 (mod 5)

d) –22 ⊗ 3 (mod 9)

e) 9 ⊗ 11 (mod 6)

f) 7 ⊗ 3 (mod 12)

g) 17 ⊗ –4 (mod 3)

h) –7 ⊗ 16 (mod 10)

i) –25 ⊗ 10 (mod 11)

j) 12 ⊗ –13 (mod 8)

Q-11 **Do each of the following multiplications in the given modulus.**

a) 5 ⊗ 11 (mod 4)

b) 9 ⊗ 6 (mod 7)

c) $-8 \otimes -3 \pmod 5$

d) $3 \otimes -22 \pmod 9$

e) $11 \otimes 9 \pmod 6$

f) $3 \otimes 7 \pmod{12}$

g) $-4 \otimes 17 \pmod 3$

h) $16 \otimes -7 \pmod{10}$

i) $10 \otimes -25 \pmod{11}$

j) $-13 \otimes 12 \pmod 8$

Q-12 **Look carefully at your answers to questions 1 and 2.**

a) Compare the questions and answers in questions 1a) and 2a), 1b) and 2b) and so on. What do you notice?

b) Is $a \otimes b \pmod n = b \otimes a \pmod n$? Give a reason for your answer.

Q-13 **Work in pairs. 1. a) If a = 25, b = 34 and n = 7, find the values of: i) [(a mod n) × (b mod n)] mod n ii) ab mod n b) If a = 58, b = 17 and n = 5, find the values of: i) [(a mod n) × (b mod n)] mod n ii) ab mod n c) Look carefully at your answers to questions a) and b). Formulate a statement about [(a mod n) × (b mod n)] mod n and ab mod n. 2. a) If a = 17 and n = 5, find the value of [(a mod n) + (–a mod n)] mod n. b) If a = 51 and n = 9, find the value of [(a mod n) + (–a mod n)] mod n. c) Look carefully at your answers to questions a) and b). Formulate a statement about [(a mod n) + (–a mod n)]. 3. Use your own numbers to test each of the following conjectures. Do at least two different tests for each one. For every 'False' answer, give an example that proves that it is not true. a) Is (a + b + c) mod n = a mod n + b mod n + c mod n? b) Is $(a + b + c) \bmod n = a \oplus b \oplus c \pmod n$? c) Is (a × b × c) mod n = a mod n × b mod n × c mod n? d) Is $(a \times b \times c) \bmod n = a \otimes b \otimes c \pmod n$?**

a) If a = 25, b = 34 and n = 7, find the values of: i) [(a mod n) × (b mod n)] mod n ii) ab mod n

b) If a = 58, b = 17 and n = 5, find the values of: i) [(a mod n) × (b mod n)] mod n ii) ab mod n

c) Look carefully at your answers to questions a) and b). Formulate a statement about [(a mod n) × (b mod n)] mod n and ab mod n.

d) If a = 17 and n = 5, find the value of [(a mod n) + (–a mod n)] mod n.

e) If a = 51 and n = 9, find the value of [(a mod n) + (–a mod n)] mod n.

f) Look carefully at your answers to questions a) and b). Formulate a statement about [(a mod n) + (–a mod n)].

g) Is (a + b + c) mod n = a mod n + b mod n + c mod n?

h) Is $(a + b + c) \bmod n = a \oplus b \oplus c \pmod n$?

i) Is $(a \times b \times c) \bmod n = a \bmod n \times b \bmod n \times c \bmod n$?

j) Is $(a \times b \times c) \bmod n = a \otimes b \otimes c \pmod n$?

Q-14 **An electric train runs around a circular track that is 5 m long. What is the shortest distance along the track from the starting point of the train if it has travelled the following distances?**

a) 4 m

b) 7 m

c) 11 m

d) 18 m

Q-15 **Mrs Ladele has an investment which will mature in 92 months' time. If it is March now, in which month will her investment mature?**

Q-16 **At a college cafeteria, pizza is served every Wednesday and hot dogs are served every nine days. If both are on the menu today, prove that they will both be on the menu in 189 days' time.**

Q-17 **Pekun was born on Friday 10th October 2014. On what day of the week will his 21st birthday fall?**

Q-18 **A bank has a security check built into its credit card numbers that works as follows: Each number consists of 13 digits. The first 12 digits are the card number and the 13th digit is a check digit. The 13th digit is chosen in such a way that the sum of the 13 digits is 9 (mod 10).**

a) Calculate the 13th digit for each of the following card numbers: i) 568 515 111 221 ii) 371 298 226 647 iii) 334 153 312 518 iv) 491 382 828 361

b) Explain mathematically how, if one of the digits of the card number is entered incorrectly, the bank will be able to pick up the fact that the card number is incorrect.

Chapter-4 Topic 4 Indices and standard form

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

a) 4 802

b) 54 698

c) 11 096

d) 67 456

e) 79 499

f) 99 999

Q-2 **Round the following numbers to the nearest 10.**

a) 5 162
b) 50 208
c) 10 198
d) 9 987
e) 8 034
f) 555

Q-3 **Write each of the following numbers to one decimal place.**

a) 15.016
b) 2.589
c) 101.08
d) 78.343
e) 65.484
f) 5.555

Q-4 **Write each of the following numbers to two decimal places.**

a) 261.063
b) 12.5018
c) 101.01
d) 65.0467
e) 5.3428
f) 15.50505

Q-5 **Write each of the following numbers to one significant figure.**

a) 5 698
b) 0.0865
c) 6 894
d) 0.00304
e) 0.994
f) 15.392

Q-6 **Write each of the following numbers to two significant figures.**

a) 10 672
b) 6 130
c) 37 210
d) 0.00285

e) 0.0755

f) 31.098

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

a) 3.126×10^2

b) $5.001 \times 10\blacksquare^2$

c) $9.407 \times 10\blacksquare$

d) $6.78 \times 10\blacksquare\blacksquare$

e) 4.10302×10^3

f) $2.424 \times 10\blacksquare$

g) $798.6 \times 10\blacksquare\blacksquare$

h) $1.7831 \times 10\blacksquare$

Q-8 **Write one trillion in expanded form.**

Q-9 **Uhuru peak on Mount Kilimanjaro is 5.895×10^3 m above sea level. Write this number in expanded form.**

Q-10 **Write each of the following numbers in standard form.**

a) 64 010

b) 0.0081

c) 125 000

d) 2 040 300

e) 0.000256

f) 625 000 000

g) 0.001009

h) 118.024

i) 1 090.807

Q-11 **The population of Nigeria is estimated to be 178.5 million. Write this in standard form.**

Q-12 **The surface area of the moon is approximately 37 930 000 km². Write this area in standard form.**

Q-13 **Find each of these products, giving the answer in standard form.**

a) $(5 \times 10^2) \times (6 \times 10\blacksquare)$

b) $(2.3 \times 10^3) \times (3.5 \times 10\blacksquare)$

c) $(6.3 \times 10\blacksquare^2) \times (0.2 \times 10\blacksquare)$

d) $(0.8 \times 10\blacksquare^3) \times (2.9 \times 10\blacksquare)$

e) $(18.2 \times 10^{\blacksquare 3}) \times (17.6 \times 10^{\blacksquare\blacksquare})$

f) $(1.4 \times 10^3)^2$

Q-14 **Find each of these quotients, giving the answer in standard form.**

a) $(6 \times 10^{\blacksquare}) \div (4 \times 10^3)$

b) $(7.434 \times 10^{\blacksquare}) \div (2.1 \times 10^{\blacksquare})$

c) $(8.8 \times 10^{\blacksquare}) \div (0.2 \times 10^{\blacksquare})$

d) $(8.1 \times 10^{1\blacksquare}) \div (0.09 \times 10^{\blacksquare})$

e) $(6.8 \times 10^{\blacksquare\blacksquare}) \div (3.4 \times 10^{\blacksquare 1})$

f) $(9.62 \times 10^{\blacksquare}) \div (2.6 \times 10^{\blacksquare})$

Q-15 **Evaluate $(15.3 \times 10^3) \times (0.6 \times 10^2)$ and express your answer:**

a) in standard form

b) in expanded form

c) correct to two significant figures

Q-16 **Evaluate $15.198 \times 10^{\blacksquare} \div 3.4 \times 10^{\blacksquare}$ and express your answer:**

a) in standard form

b) in expanded form

c) correct to two significant figures

Q-17 **Simplify and give the answer in standard form.**

a) $(7.12 \times 10^{\blacksquare}) + (9.04 \times 10^3)$

b) $(6.32 \times 10^{\blacksquare}) + (0.88 \times 10^{\blacksquare})$

c) $(9.706 \times 10^{\blacksquare 2}) - (1.124 \times 10^{\blacksquare 3})$

d) $(5.6214 \times 10^{\blacksquare 3}) - (4.5040 \times 10^{\blacksquare\blacksquare})$

e) $(9.8765 \times 10^{\blacksquare 3}) - (6.5603 \times 10^{\blacksquare\blacksquare})$

f) $(9.08 \times 10^{\blacksquare}) + (8.54 \times 10^{\blacksquare})$

Q-18 **Evaluate $(7.12 \times 10^{\blacksquare}) + (2.65 \times 10^3)$ and express your answer:**

a) in standard form

b) in expanded form

c) correct to three significant figures

Q-19 **Evaluate $(7.56 \times 10^{\blacksquare 2}) - (5.6732 \times 10^{\blacksquare\blacksquare})$ and express your answer:**

a) in standard form

b) in expanded form

c) correct to two decimal places

d) correct to three significant figures

Q-20 **One quadrillion is 10^{1}■. Write this number in expanded form.**

Q-21 **The distance from the Earth to the Sun is 149 600 000 km. Write this distance in standard form.**

Q-22 **The speed of sound is 1 230 km/h. Calculate the speed of sound in m/s. Write the answer correct to the nearest metre.**

Q-23 **The speed of light is 3 × 10■ km/s. Calculate how many metres light travels in one hour.**

Q-24 **The planet Jupiter is 778 000 000 km from the sun. The speed of light is 3 × 10■ m/s. Calculate how long it takes for sunlight to reach Jupiter. Write the answer correct to the nearest minute.**

Q-25 **There are approximately 2.5×10^{13} red blood cells and 3 × 10^{1}■ white blood cells in your body. Calculate the total of all the red and white blood cells and write the answer in standard form.**

Q-26 **Simplify, giving your answer in index form.**

a) 9■ × 9■

b) 8■ × 8^{1}■

c) 2■ × 2^{1}■

d) 4■ × 4■

e) 2^{3}■ × 2■■

Q-27 **Simplify, giving your answer in index form.**

a) v■ × v■

b) p^{3} × p■

c) q■ × q^{11}

Q-28 **Simplify, giving your answer in index form.**

a) x^{12} ÷ x■

b) v■ ÷ v■

c) v^{12} ÷ v^{1}■

Q-29 **Simplify.**

a) 4■ + 4■

b) 5^{3} + 5^{3}

c) 4^(x+1) ÷ 4

d) 5^(x+2) ÷ 25

Q-30 **Simplify, giving your answer in index form.**

a) $3^{2}\blacksquare \div 3\blacksquare$

b) $5^{1}\blacksquare \div 5^{1}\blacksquare$

c) $8\blacksquare\blacksquare \div 8^{2}\blacksquare$

d) $u^{1}\blacksquare \div u^{13}$

e) $r^{21} \div r^{1}\blacksquare$

Q-31 **Simplify, giving your answer in index form.**

a) 2^(x+5) ÷ 2^x

b) 3^(x+7) ÷ 3^(x+5)

c) 5^(7x+12) ÷ 5^(7x+7)

d) 7^(12x+10) ÷ 7^(11x+6)

Q-32 **Simplify.**

a) $3\blacksquare - 3^{3}$

b) $7\blacksquare - 7\blacksquare$

c) $9\blacksquare - 9\blacksquare$

Q-33 **Write down the value of these numbers.**

a) 100

b) 170

c) $(-20)\blacksquare$

d) $1\blacksquare\blacksquare\blacksquare$

e) $3\blacksquare\blacksquare\blacksquare$

Q-34 **Write these numbers in index form, with negative indices.**

a) $1/3^{1}\blacksquare$

b) $1/5\blacksquare$

c) 1/1 000

d) 1/64

e) 1/343

Q-35 **Write these numbers as reciprocals, with positive indices.**

a) $3\blacksquare\blacksquare$

b) $7\blacksquare\blacksquare$

c) $11\blacksquare\blacksquare$

Q-36 **Simplify the following fractions, giving your answers in index form with negative indices.**

a) y■/y■

b) x■v■/x■v¹²

c) 3x/3²x

d) 5^(x+1)/5^(3x+7)

Q-37 **Simplify.**

a) (5³)■

b) (8■)■

c) (2■³)■■

d) (2■■)^(–½)

e) (7³)■²

f) (3a²)²

g) (2x²y)³

h) (5ab³)²

i) (3³a■³)■²

j) (2x■¹)■³

Q-38 **Find the value of these numbers.**

a) 4³⁄■

b) 8²⁄■

c) 9³⁄■

d) 49³⁄■

e) 8■⁄■

Q-39 **Find the value of these numbers.**

a) 4■³⁄■

b) 8■²⁄■

c) 9²·■

d) 25¹·■

e) 49■³⁄■

Q-40 **Simplify these numbers.**

a) [(■)■■]■½■

b) [(■)■½■]■

c) (■⁄■)■¹

Q-41 **Find the value of these numbers.**

a) $100^{3/\blacksquare}$

b) $1000^{2/\blacksquare}$

c) $\blacksquare\sqrt{(2\blacksquare)}$

d) $\blacksquare\sqrt{(7^{1}\blacksquare)}$

Q-42 **Solve for x in each of the following.**

a) $5x^2 = 81 - 4x^2$

b) $x^3 = -8$

c) $x^2 = -9$

d) $7 - 4x^3 = 2\blacksquare 3$

e) $2x\blacksquare - 81 = x\blacksquare$

f) $x\blacksquare + 21 = 2\blacksquare 4$

g) $3x\blacksquare = -96$

h) $x\blacksquare - 28 = 100$

i) $x\blacksquare - 13x^2 + 36 = 0$

j) $^{1}/_{\blacksquare}(x^3 \times x^2) = 27$

k) $2x\blacksquare \cdot \blacksquare\blacksquare = 32$

l) $4x\blacksquare^{3/\blacksquare} = \blacksquare/\blacksquare$

Q-43 **Solve for x in each of the following.**

a) $5\blacksquare = 125$

b) $-3\blacksquare = -27$

c) $6 \times 18\blacksquare = 6$

d) $(-13)\blacksquare = 169$

e) $9\blacksquare = 3\blacksquare$

f) $2\blacksquare \times (2\blacksquare + 2) = 64$

g) $25^{2}\blacksquare \times 5\blacksquare = 625$

h) $6^{2}\blacksquare = 36$

i) $3\blacksquare = {}^{1}/_{\blacksquare\blacksquare\blacksquare}$

j) 4^(x+4) × (2x–1) = 1

k) $4\blacksquare + 4 \times 12 = 192$

l) $5\blacksquare \times 25\blacksquare\blacksquare^{1} = 1$

m) $2\blacksquare\blacksquare^{1} \times 8\blacksquare\blacksquare^{2} = 16^{1}\blacksquare\blacksquare$

n) $8 \times 3\blacksquare\blacksquare = 27 \times 2\blacksquare\blacksquare$

o) $3\blacksquare^{2}\blacksquare\blacksquare - 3^{32} = 0$

p) $3^{2}\blacksquare - 3 = 3^{2}\blacksquare - 7\blacksquare$

q) $7 \times 4\blacksquare\blacksquare^{2} - 2^{2}\blacksquare\blacksquare^{3} = 40$

r) $3\blacksquare\blacksquare^{1} - 3\blacksquare\blacksquare^{1} = 24\sqrt{3}$

s) $9\blacksquare^{2}\blacksquare\blacksquare \times 27\blacksquare\blacksquare^{1} = 0$

t) $2\blacksquare + 2^{1}\blacksquare^{2}\blacksquare = 9 \times 2\blacksquare^{1}\blacksquare\blacksquare$

Q-44 **The Ifedi family invested ■550 000 at a rate of 9% compound interest p.a. (per annum). What will the value of their investment be after 3 years? Use the formula A = P(1 + i)■.**

Q-45 **A tractor worth ■4 950 000 depreciates at a rate of 12% p.a. on the reducing balance. What will the value of the tractor be after 10 years? Use the formula A = P(1 – i)■.**

Q-46 **In a rural area, the population was decreasing at a rate of 3% p.a. If the population was 15 000 initially, what would the population be after 8 years? Use the formula A = P(1 – r)■.**

Q-47 **A cholera epidemic broke out in Kaduna. At the end of the first day, 150 people were infected. If the epidemic continued to increase at a rate of 16% per day, how many people were infected after 9 days? Use the formula A = P(1 + r)■.**

Q-48 **Water drips from a tap at a constant rate into a bucket. The level of the water in the bucket is given by the equation w = 2t – 1 cm, where t is time in hours.**

a) Calculate the level of water after 4 hours.

b) Calculate what the level of water in the bucket was at the start.

c) How long will it take for the level of the water to reach 63 cm?

Chapter-5 Topic 5 Logarithms

Q-1 **Write these index expressions as logarithms.**

a) $2\blacksquare = 16$

b) $3^{3} = 27$

c) $5^{3} = 125$

d) $6^{2} = 36$

e) $7^{3} = 343$

f) $4\blacksquare = 8$

g) $s\blacksquare = u$

h) 5■ = 1

i) 4■ = 32

j) 64■ = 16

Q-2 **Write these logarithms in index form.**

a) log■ 16 = 2

b) log■ 216 = 3

c) log■ 8 = ■

d) log■ 4 = ■

e) log■■ 4 = ½

f) log■ 27 = ■

g) log■ t = u

h) log■■ 1 = 0

i) log■ 50 = x

j) log■ bc = d

Q-3 **Evaluate these logarithms.**

a) log■ 49

b) log■ 25

c) log■ 64

d) log■ 81

e) log■ 64

f) log■ 32

g) log■ 243

h) log■ 512

i) log■ 729

j) log■ 625

k) log 10

l) log 100

m) log 1

n) log 1000

o) log (¹/■■■)

Q-4 **Use the graph of y = 10■ (0 ≤ x ≤ 2.2) to find the following values.**

a) log 1

b) log 25

c) log 40

d) log 80

Q-5 **Use the graph of y = 10■ (0 ≤ x ≤ 2.2) to find the following values.**

a) 10■

b) $10^{1\cdot}$■

c) $10^{1\cdot}$■

d) $10^{2.2}$

Q-6 **Write the powers of 10 to one decimal place for the following.**

a) 20

b) 40

c) 60

d) 80

Q-7 **Given: log 2 = 0.3010, log 3 = 0.4771 and log 5 = 0.6990. Use only these values to write these logarithms to four decimal places.**

a) log 4

b) log 10

c) log 9

d) log 15

e) log 12

f) log (■)

g) log (■/■)

h) log 27

i) log 45

j) log 0.6

Q-8 **Write these logarithms in terms of log a, log b and log c.**

a) log a^2

b) log ab

c) log abc

d) log (a/b)

e) log a^2b

f) log √a

g) log ((ab)/c)

h) log (a/(bc))

i) log a^2b^2c

j) log √(ab/c)

Q-9 **Simplify the following expressions.**

a) 3 log a + log b + log c

b) log a – log b + log c

c) 2 log a + 2 log b

d) ½ log a + log b

e) 2 log a – 3 log b

Q-10 **Simplify the following logarithmic expressions.**

a) log 1000

b) log■ 9 + log■ 27

c) log■ 1000 – log■ 8

d) log■ 25 – log■ 0.125 – log■ 64

e) log■ 16 – log■ 1 + 2 log■ (1/9) – log■ (1/4)

Q-11 **Express the following in standard form.**

a) 1 000

b) 32 560

c) 456.9

d) 69.98

Q-12 **State the characteristics of these logarithms.**

a) 365.8

b) 42.7

c) 6 790

d) 9.03

Q-13 **State the mantissa of these logarithms.**

a) 5.86

b) 93.2

c) 790.3

d) 10.12

Q-14 **Use the log table to find the logarithms of the following numbers.**

a) 700

b) 70

c) 3 650

d) 36.5

Q-15 **Use the log table to find the antilogarithms of the following numbers.**

a) 4

b) 3.86

c) 1.235

d) 0.741

Q-16 **Use the log table to calculate the following.**

a) 8.01 × 6

b) 9.23 × 20

c) 36.4 × 12.1

d) 6.2 ÷ 3.8

e) 42.7 × 32

f) 864.2 ÷ 43

g) $(61.2)^2$

h) 32.1 × 5.3 × 6.4

Q-17 **Evaluate the following, using log tables.**

a) (76.25 × 45) ÷ 39

b) (195.2 × 1.4) ÷ 47.5

c) (6.904 × 98.5) ÷ 20.05

d) $(8.3)^2$ ÷ 53.8

Q-18 **Evaluate the following, using log tables.**

a) $(7.3)^2$

b) $\sqrt{515}$

c) ■9.72

d) $(1.02)^3$

Q-19 **Educare shares increased in value from ■75.80 per share to ■83 per share in 12 months. What was the growth rate of the share? Write the answer correct to one d.p.**

Q-20 **Mrs Ndwani invested ■150 000 in a savings account at the bank. How much interest did she earn after three years at 13% interest, compounded annually? Use the formula A = P(1 + i)■.**

Q-21 **The gross domestic product (GDP) measures the national income and output for a country's economy. If the GDP of Nigeria is measured at $530 billion and grows at a rate of 3.96% per year, what will be the GDP in one year's time? Write the answer to the nearest Naira.**

Q-22 **During one day, 11 890 600 shares were traded at the NSE (Nigerian Stock Exchange) in Lagos. If the average value of each share was ■18.95, calculate the total value of the traded shares.**

Q-23 **How long will it take an amount of ■220 000 to increase to ■358 600 if the money is deposited into an account at the bank paying 13% p.a. compound interest? Round the answer to a whole number.**

Q-24 **If the price of petrol is ■87 a litre and increases by the inflation rate of 8.7% in one year, what will be the new cost of petrol per litre?**

Q-25 **Mr Kalu bought 5 700 shares at ■12.36 per share. Calculate how much money he made on his investment if he sold the shares a year later at ■13.32 per share.**

Q-26 **An investor paid ■39 600 for 15 000 shares.**

a) Calculate the price per share.

b) She sold half the shares at a price of ■3.10 per share. Did she make a profit or loss?

c) Calculate the value of the remaining shares at ■3.10 per share.

Chapter-6 Topic 6 Linear equations and variations

Q-1 **Make the variable given in brackets the subject of the equation.**

a) $a + 2 = (b + 3)/5$ (b)

b) $x = 6(y – z)$ (z)

c) $a^2 = 16\ b^2\ c^2$ (c)

d) $a = [n/(n – 2)]\cdot 180$ (n)

e) $d = \sqrt{(b^2 – 4\ a\ c)}$ (a)

f) $a = b^2 + 2\ c$ (b)

g) $V = \pi\ r^2\ h$ (r)

h) $A = 2\ \pi\ r^2 + 2\ \pi\ r\ h$ (h)

i) $a = (b + 3)/(b – 3)$ (b)

j) $x^2 = y^2 + w^2$ (w)

k) $1/m = 1/n - 1/p$ (p)

l) $C = (5/9)(F - 32)$ (F)

m) $T = 2\pi\sqrt{(k/(M\ H))}$ (H)

n) $1/x = 1 - 1/(y + 1)$ (y)

o) $S = n/2\ [2\ a + (n - 1)\ d]$ (d)

Q-2 **Solve the following equations.**

a) $3 \times (2x - 9) = 5 \times (2x - 3)$

b) $2 \times (2x - 1) + x = 4 + 3x$

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

d) $1/3 + 5/x = 3/4$

e) $1/3 \times (x - 2) = 1/5 \times (4x - 1)$

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

g) $x/[3 \times (x - 2)] - 1 = x/(x - 2)$

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

i) $2 \times (x - 1)/3 - 3/4 - 1 = 3 \times (2x + 3)/2 - 10/3$

j) $8/(x + 5) = (2 \times (x + 4))/x$

Q-3 **Describe how the area of a square varies with its length. Write down the relationship in mathematical terms.**

Q-4 **Given that y varies as the square of x, and that y = 9 when x = 4, find:**

a) the formula relating y and x

b) the value of y when x = 12

Q-5 **If y varies directly as x varies, and y = 7 when x = 4:**

a) establish a relationship between x and y

b) find the value of x when y = 1/2

Q-6 **Given that p varies as the square of q varies, and that p = 90 when q = 15,**

a) find the value of p when q = 5

b) find the value(s) of q when p = 160

Q-7 **Given that the surface area of a sphere, A, varies directly with the square of its radius, r, and that $A = 4\pi r^2$:**

a) establish a relationship between A and r

b) find the value of A when r = 1/2

c) find the value of r when $A = 16\pi r^2$

Q-8 **If m is directly proportional to n and m = 3 when n = 18, find the value of m when n = 42.**

Q-9 **Given that r varies directly as t varies, and r = 175 when t = 35,**

a) establish a relationship between r and t

b) find the value of r when t = 3

c) find the value of t when r = 200

Q-10 **The height, h, of water in a can varies directly as the time taken, t, to fill the can varies. Given that h = 4.2 cm when t = 10 seconds, find the time taken for the can to be filled to a height of 6.3 cm.**

Q-11 **The volume of air in a sphere varies directly with the cube of its radius. The volume is 64 cm^3 when the radius is 8 cm. Find the volume when the radius is 10 cm.**

Q-12 **Given that y is directly proportional to the square of x and y = 40 when x = 2,**

a) establish a relationship between y and x

b) find the value of y when x = 5

Q-13 **Given that m is inversely proportional to n and that m = 2 when n = 5, find:**

a) the relationship between m and n

b) the value of m when n = 10

c) the value of n when m = 6

Q-14 **The table represents the relationship 'y varies inversely as x varies'. Find the values of a and b.**

Q-15 **If y varies inversely as the square of x – 4 varies, write the equation relating y and x – 4, including the constant of proportionality.**

Q-16 **If in question 1, y = 5 when x = 2, find:**

a) a relationship between y and x – 4

b) the value of y when x = 5

c) the values of x when y = 1/5

Q-17 **Given that v varies inversely as the square of u varies, and v = 10 when u = 5, find:**

a) the equation relating v and u^2

b) the value of v when u = 10

c) the values of u when v = 10

Q-18 **Given: r varies inversely as the square root of t varies. Write the relationship between r and t, including the constant of proportionality.**

Q-19 **If r is 4 when t = 9:**

a) establish a relationship between r and t

b) find the value of r when t = 25

c) find the value of t when r = 8

Q-20 **If x varies inversely as the square root of y varies, and x = 1 when y = 4:**

a) establish a relationship between x and y

b) find the value of x when y = 9

c) find the value of y when x = 12

Q-21 **Given that a is inversely proportional to b, find the values of x and y in the table (b: 7, x, 11; a: 99, 77, y).**

a) find x

b) find y

Q-22 **Quantity y is inversely related to x. Given that y = 20 when x = 2, find:**

a) the relationship between y and x

b) the value of y when x = 10

c) the value of x when y = 2

Q-23 **Given that y varies inversely as the square root of x varies, and y = 40 when x = ½, find:**

a) the relationship between y and x

b) the value of y when x = ■

c) the value of x when y = 1.6

Q-24 **If x varies inversely as the square root of y varies, and x = 2 when y = 9, find:**

a) the value of x when y = 16

b) the value of y when x = ½

Q-25 **Given that y is inversely proportional to x + 8, find:**

a) the relationship between y and x + 8 if y = 1 when x = 1

b) the value of y when x = 10

Q-26 **Given that z is inversely proportional to the square of (p − 12), find:**

a) the relationship between z and (p – 12) if z = 13 when p = 13

b) the value of z when p = 9

c) the value of p when z = 1/13

Q-27 **If $p \propto 1/\sqrt{q}$ and q = 25 when p = 2, find the value of q when p = 100.**

Q-28 **If y varies inversely as the cube of x varies, and y = 2 when x = 2, find the value of y when x = 4.**

Q-29 **Given that y varies inversely as the cube of (a + 3) varies, and y = 2 when a = 1, find the value of y when a = 4.**

Q-30 **$P \propto QR$ when Q = 4, R = 9 and P = 6.**

a) Find the relationship between P, Q and R.

b) Find Q when P = 8 and R = 12.

Q-31 **If A, B and C are related so that $A \propto B^2/C$, and A = 36 when B = 3 and C = 4, calculate B when A = 200 and C = 2.**

Q-32 **M varies directly with N and inversely with P. M = 3 when N = 240 and P = 40.**

a) Write the equation relating M, N and P.

b) Calculate M when N = 120 and P = 30.

Q-33 **A varies jointly with B and $\sqrt{C}$. When A = –18, B = 2 and C = 9, find B when A = 10 and C = 4.**

Q-34 **The volume of wood in a tree V varies directly with height h and inversely with the square of circumference c. If V = 144 m^3 when h = 20 m and c = 1.5 m, find the height h when V = 1 000 m^3 and c = 2 m. Write the answer to the nearest metre.**

Q-35 **M varies directly with N and inversely with P^2. If M = 8 when N = 6 and P = 3, express M in terms of N and P.**

Q-36 **The quantity n is partly constant and partly varies with m^2. Given that n = 11 when m = 1 and n = 5m when m = 2, find n when m = 4.**

Q-37 **The resistance r to the movement of a vehicle is partly constant and partly proportional to v^2. If r = 350 N when v = 50 km/h and r = 190 N when v = 30 km/h, find the speed v that gives r = 302.5 N.**

Q-38 **The Afolabi family receives a monthly electricity bill C. When E = 500 kW, C = ■7 420; when E = 600 kW, C = ■7 604.**

a) Write a formula relating C, A and E.

b) Calculate C when E = 550 kW.

Q-39 **The cost of running a business is partly constant and partly varies with the number of employees. If the cost is ■28 295 for 60 employees and ■32 495 for 75 employees, find the cost for 80 employees.**

Chapter-7 Topic 7 Quadratic equations

Q-1 **Factorise these expressions.**

a) $10x - 35$

b) $c^2 - c$

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

d) $10x^2 - 15y^2$

e) $3y^2 + 12y - 6$

f) $2ab - 8a^2b - 4ab^2$

g) $5p - 10q + 15r$

h) $4x^2 + 6x - 2$

i) $18x^2 - 9$

j) $8r^2 - 16r + 4$

Q-2 **Factorise these binomials.**

a) $x^2 - 25$

b) $c^2 - 1$

c) $4a^2 - 9$

d) $x^2 - y^2$

e) $16y^2 - 25$

f) $144 - a^2$

g) $49 - d^2$

h) $4x^2 - 1$

i) $2x^2 - 18$

j) $8r^2 - 2$

Q-3 **Factorise these trinomials.**

a) $x^2 + 10x + 25$

b) $a^2 + 4a + 4$

c) $a^2 - 6a + 9$

d) $x^2 - x - 20$

e) $y^2 - 7y + 10$

f) $x^2 + x - 12$

g) $d^2 + 2d - 15$

h) $x^2 + 4x - 12$

i) $2x^2 - 26x + 24$

j) $r^2 - 12r + 36$

Q-4 **Factorise these expressions fully.**

a) $2x^2 + 20x$

b) $3x - 6xy - 2y + 1$

c) $x^2 - 8x + 16$

d) $3x^2 - 3x - 60$

e) $3xy - 5xz + 15yz - 9y^2$

f) $2y^2 - 14y + 24$

g) $3x^2 + 6x - 45$

h) $4a^2 + 20a + 24$

i) $4x^2 + 12xy + 9y^2 - 25$

j) x■ – 1

Q-5 **Solve for x.**

a) $x^2 - 1 = 0$

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

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

d) $2x^2 - 4x = 0$

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

f) $x^2 = 49$

g) $8x^2 = 2$

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

i) $x^2 - 9 = 0$

j) $8x^2 - 16x = 0$

Q-6 **Solve these quadratic equations.**

a) $4x^2 = 100$

b) $5c^2 - 20 = 0$

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

d) $2y^2 - 8 = 0$

e) $16y^2 = 25$

f) $2a^2 = 242$

g) $64 - d^2 = 0$

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

i) $2x^2 - 32 = 0$

j) $25x^2 - 36 = 0$

Q-7 **Solve for x by factorising.**

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

b) $2x^2 - x - 1 = 0$

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

d) $2x^2 - 9x - 5 = 0$

e) $x^2 - 6x - 7 = 0$

f) $x^2 - x - 30 = 0$

g) $x^2 + 2x - 15 = 0$

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

i) $x^2 - 13x = -12$

j) $2x^2 + x - 6 = 0$

Q-8 **Solve these quadratic equations.**

a) $x^2 - 10x = 24$

b) $6x^2 - 4x = 10$

c) $10x^2 + 9x + 2 = 0$

d) $3x(x - 1) = 60$

e) $9x^2 - 12x + 4 = 0$

f) $2x(x - 7) = -24$

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

h) $1/(2x) - (4x - 5)/3 = 0$

Q-9 **Complete the square of each of these quadratic expressions.**

a) $x^2 + 6x + 9$

b) $x^2 - 8x + 16$

c) $x^2 + x - 4$

d) $-x^2 - 2x + 3$

e) $2x^2 + x - 4$

f) $-3x^2 + 6x + 1$

Q-10 **Complete the square of each of these quadratic expressions.**

a) $x^2 - b\,x + 1$

b) $a\,x^2 + 4x - 2$

c) $a\,x^2 + 2x - 3$

d) $-2\,a\,x^2 - 4x + 6$

Q-11 **Decide whether these expressions have a maximum or minimum value.**

a) $x^2 + 4x + 4$

b) $-x^2 + 10x - 25$

c) $2x^2 + 2x - 8$

d) $-3x^2 - 6x + 9$

Q-12 **Calculate the coordinates of the minimum or maximum values of the expressions in question 3.**

Q-13 **Solve these quadratic equations by completing the square.**

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

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

c) $x^2 - 8x - 9 = 0$

d) $5x^2 - 30x + 25 = 0$

Q-14 **Solve these quadratic equations by completing the square. Give your answers in simplified surd form, where necessary.**

a) $x^2 - 5x + 3 = 0$

b) $x^2 - 3x + 1 = 0$

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

d) $ax^2 - x + 1 = 0$

Q-15 **Solve these quadratic equations by completing the square. Give your answers correct to two decimal places.**

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

b) $x^2 + 4x + 2 = 0$

c) $-x^2 + 7x - 5 = 0$

d) $-2x^2 - 12x + 3 = 0$

e) $8x^2 + 6x - 3 = 0$

f) $3x^2 - 4x - 6 = 0$

Q-16 **Solve these quadratic equations (give your answers in simplified surd form).**

a) $x^2 + 4x - 6 = 0$

b) $-x^2 + 6x + 11 = 0$

c) $-x^2 - 8x - 9 = 0$

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

e) $x^2 + bx - c = 0$

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

Q-17 **Solve for x, correct to two decimal places where necessary.**

a) $x^2 - 5x + 3 = 0$

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

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

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

e) $x^2 - 3x + 1 = 0$

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

Q-18 **Determine the roots of the equations.**

a) $2x^2 + x - 6 = 0$

b) $x^2 + 4x + 2 = 0$

c) $-x^2 + 2x + 5 = 0$

d) $-2x^2 + 10x - 6 = 0$

e) $-2x^2 - 12x + 3 = 0$

f) $8x^2 + 6x - 3 = 0$

Q-19 **Solve for x (give your answers in simplified surd form or to two decimal places where necessary).**

a) $x(x + 1) = 6$

b) $x^2 = 4 - x$

c) $x(x + 3) = 7$

d) $(x - 3)^2 = 6$

e) $(2x)^2 - x(x - 14) = 5$

f) $\frac{1}{2} x^2 + 3x = 5$

Q-20 **Find the equation of each of these graphs.**

a) cuts the x axis at –6 and 4 and the y axis at –12

b) cuts the x axis at –1 and 5 and the y axis at –5

c) cuts the x axis at –3 and 1 and passes through point (–2; –6)

d) cuts the x axis at –3 and 0 and passes through point (1; –4)

Q-21 **Use tables to draw these quadratic graphs for $x \in [-3; 3]$.**

a) $y = 3x^2$

b) $y = -x^2$

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

d) $y = 4x^2 - 1$

e) $y = x^2 - 3x - 4$

Q-22 **Given: the function $y = x^2 + x - 2$.**

a) What is the value of y when x = 0?

b) What are the values of x when y = 0?

c) Determine the equation of the axis of symmetry.

d) Will the arms of the graph go up or down?

e) Sketch the graph of the function.

Q-23 **Find the line of symmetry of each of these functions.**

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

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

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

d) $y = 3x^2 - 7x + 2$

Q-24 **Find the coordinates of the turning point of each graph in question 3.**

Q-25 **Decide whether the arms of these graphs go up or down.**

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

b) $y = -2x^2 + x - 4$

c) $y = 2(x^2 - 3)$

d) $y = -x^2 + 12x + 6$

Q-26 **Draw these quadratic graphs.**

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

b) $y = x^2 - 9x + 14$

c) $y = x^2 - 2x - 15$

d) $y = -x^2 + x + 12$

Q-27 **In rectangle DEFG, DE = x cm and EF is 1.5 cm less than DE. If the area of the rectangle is 52 cm², find the dimensions of the rectangle.**

Q-28 **The sides of a right-angled triangle are (x + 11) mm and (x – 3) mm and the hypotenuse is 2x mm. Find the value of x.**

Q-29 **Solve:**

a) What are the dimensions of the largest rectangular area that can be enclosed using 12 m of fencing if an existing wall is used as one of the sides?

b) Calculate the maximum area.

Q-30 **The sum of the digits of a two-digit number is 13 and the product of the digits is 36. Find the two numbers.**

Q-31 **Mr Okonta travels 400 km from Lagos to visit his daughter. He drives by car and travels 20 km/h faster than the train going the same distance. He arrives at his daughter's town 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?**

Q-32 **A painter and her apprentice paint a building in 24 days. If each woman had worked separately, the apprentice would have taken 20 days longer than the painter to complete the job. Calculate the number of days each woman would take to complete the job on her own.**

Chapter-8 Topic 8 Sets

Q-1 **List all the elements of the following sets.**

a) days of the week

b) factors of 24

c) the first six multiples of 4

Q-2 **State a rule that describes the following lists.**

a) 1, 3, 5, 7, 9, 11

b) 2, 3, 5, 7, 11

c) Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

Q-3 **The set P = {4, 6, 9} is given.**

a) Write down the cardinality of set P.

b) Write down all the subsets of P.

c) Is P a finite or infinite set?

Q-4 **Complete each of the following by writing one of these symbols: $\in$ or $\notin$.**

a) 18 ___ {prime numbers}

b) 91 ___ {multiples of 7}

c) Igbo ___ {languages spoken in Korea}

d) 144 ___ {square numbers}

Q-5 **Give ten examples of sets. Write each set in set notation.**

Q-6 **Give ten examples of sets. Write each set in set notation.**

Q-7 **Write down the cardinal number of each of these sets: A = {prime numbers from 1 to 10}, B = {teachers who teach your class}, C = {boys in your class}, D = {odd numbers from 1 to 1000}, E = {grains of sand in the Sahara desert}, F = {x: x is a factor of 12}, G = {goat, cat, dog, sheep, cow, horse}.**

Q-8 **State whether these sets are finite or infinite: A = {girls in your class}, B = {multiples of 3 from 1 to 50}, C = {2, 4, 6, 8, …}, D = {x: x is the number of countries in the world}, E = {x: x is the number of states in Nigeria}, F = {x: x is a fraction between 1 and 2}.**

Q-9 **Which of these sets are empty, which are singletons, which are equal, and which are equivalent? A = {prime numbers divisible by 7}, B = {odd numbers divisible by 2}, C = {1, 2, 3, 4}, D = {the first four multiples of 5}, E = {p, q, r, s}, F = {20, 15, 10, 5}.**

Q-10 **Consider the following sets: A = {prime numbers}, B = {even numbers}, C = {odd numbers}, D = {multiples of 3}. Which two sets are disjoint?**

Q-11 **Fill in the correct relation sign ($\subset$, $\supset$ or $\not\subset$) in the blank spaces.**

a) {2, 4, 6, 8} ___ {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

b) {pawpaws, bananas, mangoes} ___ {animals}

c) {fruits} ___ {pawpaws, bananas, mangoes}

d) {2, 3, 5, 7} ___ {2, 3, 5, 6}

e) { } ___ {2, 4, 6, 8, 10}

f) {1, 2, 3, 4, 5} ___ {2, 4}

g) {animals} ___ {domestic animals}

Q-12 **Find the power set of these sets and write down the cardinality of this power set.**

a) P = { }

b) Q = {1}

c) R = {a, b}

d) S = {a, b, c}

e) T = {2, 4, 6, 8}

Q-13 **List all the possible subsets of each of the following sets.**

a) {a, b}

b) {a, b, c}

c) {a, b, c, d}

d) {a, b, c, d, e}

Q-14 **Complete the table below.**

Number of elements in a set: 0, 1, 2, 3, 4, 5 Number of subsets: ___

Q-15 **Generalise your findings: The number of subsets in a set P with n elements is ___.**

Q-16 **Given: A = {4, 5, 8, 16}, B = {2, 4, 8, 16} and C = {7, 9, 15}. List all the elements in each of the following.**

a) $A \cup B$

b) $B \cup C$

c) $A \cup C$

d) $A \cup B \cup C$

Q-17 **Given: X = {1.5, 2, 2.5, 3, 3.5}, Y = {3, 3.5, 4, 4.5, 5} and Z = {4.5, 5, 5.5, 6, 6.5}. List all the elements in each of the following.**

a) $X \cup Y$

b) $X \cup Z$

c) $Y \cup Z$

d) $X \cup Y \cup Z$

Q-18 **Given: P = {3, 7, 21, 147}, Q = {2, 4, 8, 32} and R = {1, 3, 5, 15, 65}. List all the elements in each of the following.**

a) $P \cup R$

b) $R \cup Q$

c) $Q \cup P$

d) $R \cup P \cup Q$

Q-19 **Given: A = {1, 2, 3, 4, 5, 6}, B = {2, 4, 6, 8} and C = {1, 2, 4, 8, 16}. List all the elements in each of the following.**

a) $A \cap B$

b) $B \cap C$

c) $A \cap C$

d) $A \cap B \cap C$

Q-20 **Given: X = {–5, –4, –3, –2, –1}, Y = {–11, –9, –7, –5} and Z = {–9, –3, –1}. List all the elements in each of the following.**

a) $X \cap Y$

b) $X \cap Z$

c) $Y \cap Z$

d) $X \cap Y \cap Z$

Q-21 **Given: P = {a, p, p, l, e}, Q = {m, a, n, g, o} and R = {o, r, a, n, g, e}. List all the elements in each of the following.**

a) $P \cap R$

b) $R \cap Q$

c) $Q \cap P$

d) $R \cap P \cap Q$

Q-22 **Given the sets V = {all even numbers}, O = {all odd numbers} and P = {all prime numbers}, say whether the following pairs of sets are disjoint or not. If the sets are not disjoint, give one example of an element of the intersection of the sets.**

a) V and O

b) V and P

c) O and P

Q-23 **In the Venn diagram: B = {students who take Biology}, M = {students who take Mathematics}, P = {students who take Physics}.**

a) How many students take Biology?

b) How many students take either Mathematics or Physics?

c) How many students take only Physics?

d) How many students take all three subjects?

e) How many students take either Biology or Mathematics or Physics?

Q-24 **All the 250 students in a class learn German or Spanish or both. Given that 144 students learn German and 128 learn Spanish, how many students learn both languages?**

Q-25 **In a class of 70 boys, each boy takes part in either football or basketball or both. Given that 40 boys play football and 8 play both football and basketball, find how many boys play basketball.**

Q-26 **In a household survey, it was discovered that 85 of the homes visited had televisions, 128 had radios and 32 had both a television and a radio. How many households were there in the survey?**

Q-27 **Given that $n(X) = 18$, $n(Y) = 36$ and $n(X \cup Y) = 50$, find $n(X \cap Y)$.**

Q-28 **Given that $n(P) = 28$, $n(Q) = 36$ and $n(P \cap Q) = 8$, find $n(P \cup Q)$.**

Q-29 **Given that $n(S) = 18$, $n(S \cup T) = 40$ and $n(S \cap T) = 5$, find $n(T)$.**

Q-30 **Given that $n(A) = 118$, $n(B) = 98$, $n(C) = 94$, $n(A \cap B) = 42$, $n(B \cap C) = 24$, $n(A \cap C) = 34$ and $n(A \cap B \cap C) = 8$, find $n(A \cup B \cup C)$.**

Q-31 **The pets of five families are represented in set form, as follows: The Ozobia family: {dogs, goats, sheep} The Mordi family: {cats, chickens} The Ifedi family: {cats, dogs, rabbits}. List the universal set for the pets that these families own.**

Q-32 **A teacher wrote down the birthdays of all the students in her class.**

a) List the universal set for the months of the birthdays

b) List the universal set for the days of the months of the birthdays

Q-33 **Some of the languages spoken in Nigeria are Igbo, Yoruba, Fulfulde, Kanuri, Hausa and Ibibio.**

a) List the universal set for this situation

b) How many subsets are there in the universal set in question a)?

Q-34 **Write down n(ξ) for each of the following situations.**

a) There are 39 boys and 28 girls in a class

b) A box of shapes contains triangles, circles, squares, rectangles, parallelograms, kites, pentagons and hexagons

Q-35 **Consider these sets of numbers, and identify the universal set: J = {the first six prime numbers}, L = {the first five multiples of 3}, M = {all the factors of 16}.**

Q-36 **Given the following sets: ξ = {a, b, c, e, f, h, i, k, m, o, p, r, s, t, w}, C = {c, h, r, i, s, t, o, p, h, e, r} and T = {t, a, p, i, w, a, h}.**

a) Draw the Venn diagram of this situation.

b) List the elements in C ∩ T.

c) List the elements in C ∪ T.

Q-37 **Given the following sets: ξ = {integers between 1 and 29}, X = {multiples of 2 between 1 and 29}, Y = {prime numbers between 1 and 29} and Z = {multiples of 3 between 1 and 29}.**

a) Draw the Venn diagram of this situation.

b) List the elements in X ∩ Y.

c) List the elements in Y ∩ Z.

Q-38 **In a school of 272 students, 70 are members of the Science Society. 30 belong to both the Science and Debating Societies. 142 belong to neither society. How many students belong to the Debating Society?**

Q-39 **A party of 120 tourists planned to visit Nigeria, Cameroon and Benin. 68 tourists visited Cameroon and 70 tourists visited Benin. 40 tourists visited Nigeria and Cameroon, 46 tourists visited Nigeria and Benin and 37 tourists visited Benin and Cameroon. 25 tourists visited all three countries. How many tourists visited Nigeria altogether?**

Q-40 **A teacher is handing out textbooks to a SS1 class. Every student in the class gets a Maths book. The teacher hands out 48 Maths books, 22 Geography textbooks, 17 History textbooks and 18 Science textbooks. 7 students take History and Geography, 9 students take Science and Geography and 5 students take History and Science. 9 students do not take Geography, History or Science. How many students take all four subjects? (Hint: View the Maths students as the universal set, because every student is also a Maths student.)**

Q-41 **A trader reported to a manufacturer on the faults that occurred in 45 radios. He reported the following findings: Fault A occurred 25 times. Fault B occurred 20 times. Fault C occurred 22 times. Faults A and B occurred 4 times. Faults A and C occurred 3 times. Faults B and C occurred 10 times. Only once did all three faults occur in a single radio. Use a Venn diagram to explain why the manufacturer did not believe the trader's report.**

Q-42 **If ξ = {a, b, c, d, e, f, g, h, i}, give the complement of each of the following.**

a) {a, b, d}

b) {c, d, e, i}

c) {a, c, e, g, i}

d) { }

e) ξ

Q-43 **If ξ = {all positive integers}, describe the complement of each of the following in words.**

a) {all positive even numbers}

b) {all positive rational integers}

c) {all prime numbers}

d) {1, 2, 3, 4, 5, 6, 7, 8, 9}

Q-44 **If ξ = {all positive multiples of 5} and A = {all positive multiples of 10}, describe A' in words.**

Q-45 **Given: A = {all prime factors of 30} and B = {all prime factors of 105}, and ξ = A $\cup$ B.**

a) List the elements of A and of B.

b) List the elements of A' and of B'.

c) Draw a Venn diagram to illustrate the relation between A and B, labeling each component of the diagram.

d) List the elements of A $\cap$ B and of A $\cup$ B.

e) Find the HCF and LCM of 30 and 105.

f) If C = {all prime factors of the HCF of 30 and 105}, and D = {all prime factors of the LCM of 30 and 105}, list the elements of C and D.

g) What do you notice about the sets A $\cap$ B, A $\cup$ B, C and D?

Q-46 **Given: ξ = {prime factors less than 20}, A = {prime factors of 252}, and B = {prime factors of 1716}.**

a) List the elements of ξ, A and B.

b) Draw a Venn diagram to illustrate the relation between ξ, A and B, marking each component of the diagram.

c) List the elements of $A \cap B$, $A \cup B$, $(A \cap B)'$, $(A \cup B)'$, $A' \cap B'$, $A' \cup B'$. What do you notice?

d) Find the HCF and LCM of 252 and 1716.

Chapter-9 Topic 9 Mensuration: Circles

Q-1 **Calculate the circumference of the following circles.**

a) radius = 4.2 cm

b) radius = 12.3 cm

c) diameter = 8.9 cm

d) diameter = 24.3 cm

Q-2 **Calculate the radius of the circle when the circumference is:**

a) 18 cm

b) 49 cm

c) 67 cm

d) 55 mm

Q-3 **Calculate the length of the minor arc in the circle with:**

a) r = 5 cm and $\theta = 67°$

b) r = 15 cm and $\theta = 79°$

c) d = 12 cm and $\theta = 102°$

d) d = 26 cm and $\theta = 58°$

Q-4 **Calculate the radius of the circle for the angle at the centre and the arc length PQ that are given.**

a) PQ = 12 cm and $\theta = 32°$

b) PQ = 8 cm and $\theta = 67°$

c) PQ = 9.2 cm and $\theta = 88°$

d) PQ = 12.3 cm and $\theta = 95°$

Q-5 **Calculate the size of the angle, α, when the radius and arc length of a circle are given.**

a) r = 25 cm and arc length = 16 cm

b) r = 8.4 cm and arc length = 21 cm

c) r = 5.1 cm and arc length = 7.5 cm

d) r = 6.3 cm and arc length = 2.9 cm

Q-6 **Calculate the length of the major arc for the circles in question 5.**

Q-7 **Calculate the radius of the sector of a circle with:**

a) length of sector 52 mm and angle at centre 83°

b) length of sector 73 mm and angle at centre 108°

c) length of sector 121 mm and angle at centre 147°

d) length of sector 69.3 mm and angle at centre 68°

Q-8 **The wheel of a bicycle has a radius of 30 cm. Calculate how far a cyclist has travelled after the wheel has rotated 50 times.**

Q-9 **A garden is made up of a rectangular patch of ground and a semicircular flower bed at one end of the rectangle. If the length is 15 m and the width is 6 m, calculate the perimeter of the garden.**

Q-10 **Calculate the perimeter of the sector in the circle with radius 7 cm and angle 60°.**

Q-11 **Calculate the perimeter of the semi■circle with diameter 6 cm.**

Q-12 **Calculate the perimeter of the shapes below.**

Q-13 **Calculate the area of the sector in a circle with:**

a) radius 4 cm and angle between the radii 79°

b) radius 15 cm and angle between the radii 92°

c) diameter 24 cm and angle between the radii 63.2°

d) diameter 16.8 cm and angle between the radii 143.6°

Q-14 **Calculate the radius of the sector of a circle with:**

a) area of sector 92 cm^2 and angle at centre 63°

b) area of sector 143 cm^2 and angle at centre 105°

c) area of sector 32 cm^2 and angle at centre 14°

d) area of sector 68 cm^2 and angle at centre 48°

Q-15 **Calculate the area of ■ABC in the triangles below.**

a) 30° , sides 6.9 cm and 10.4 cm

b) 50° , side 7 and accompanying sides as shown

Q-16 **Calculate the area of the minor segments of a circle with radius 20 mm and the angles at the centre given below.**

a) 113°

b) 137°

c) 99°

d) 165°

Q-17 **Calculate the area of the major segments of the circle for the angles given in question 4.**

a) 113°

b) 137°

c) 99°

d) 165°

Q-18 **Calculate the area of the minor segments of circles with:**

a) radius 20 cm and angle at centre 148°

b) radius 25.8 cm and angle at centre 93°

c) diameter 78 cm and angle at centre 63.2°

d) diameter 60.8 cm and angle at centre 105.2°

Q-19 **The semicircle below consists of three equal sectors. If the radius of the circle is 90 mm, calculate the area of each sector.**

Q-20 **Calculate the area of the shapes below.**

a)

b)

c)

d)

Chapter-10 Topic 10 Trigonometry

Q-1 **In ■ABC, find the values of each of the following.**

a) sin A

b) cos A

c) tan A
d) sin B
e) cos B
f) tan B

Q-2 **In ■DEF, find the values of each of the following.**

a) sin D
b) cos D
c) tan D
d) sin F
e) cos F
f) tan F

Q-3 **In ■GHI, find the values of each of the following.**

a) HI
b) sin H
c) cos H
d) tan H
e) sin I
f) cos I
g) tan I

Q-4 **In ■JKL, find the values of each of the following.**

a) KL
b) sin J
c) cos J
d) tan J
e) sin L
f) cos L
g) tan L

Q-5 **In ■MNO, find the values of each of the following.**

a) MO
b) sin M
c) cos M
d) tan M
e) sin O
f) cos O

g) tan O

Q-6 **Use the trigonometric tables on pages 286 to 291 or a calculator to find each of the following trigonometric ratios. Round off your answers to two decimal places.**

a) tan 74°

b) cos 55°

c) sin 5°

d) cos 66°

e) sin 63°

f) tan 45°

g) sin 21°

h) cos 77°

Q-7 **Use the trigonometric tables on pages 286 to 291 or a calculator to find the size of each of the following angles. Round off your answers to one decimal place.**

a) θ if $\cos \theta = 0.43$

b) θ if $\tan \theta = 0.58$

c) θ if $\sin \theta = 0.17$

d) θ if $\tan \theta = 8.95$

e) θ if $\cos \theta = 0.71$

f) θ if $\sin \theta = 0.62$

g) θ if $\tan \theta = 2$

h) θ if $\cos \theta = 0.36$

Q-8 **Solve ■PQR by calculating the values of the following.**

a) Pˆ

b) PQ

c) QR

Q-9 **Solve ■XYZ by calculating the values of the following.**

a) Xˆ

b) Zˆ

c) YZ (using trigonometry)

d) YZ (using the theorem of Pythagoras)

Q-10 **Solve each of the triangles below by calculating the lengths of the missing sides and the sizes of the missing angles.**

a)

b)

c)

d)

Q-11 **For each of the following triangles, first draw a rough sketch of the triangle and then solve the triangle.**

a) In ■TRI, T$\hat{}$ is a right angle, TR = 6 cm and RI = 7.5 cm

b) In ■HAL, A$\hat{}$ is a right angle, H$\hat{}$ = 5° and AH = 25 mm

c) In ■DOG, O$\hat{}$ is a right angle, DO = 31 and GO = 58

d) In ■FLY, L$\hat{}$ is a right angle, FY = 83 and Y$\hat{}$ = 32°

e) In ■CAT, T$\hat{}$ is a right angle, AC = 14 m and AT = 7 m

f) In ■ANT, T$\hat{}$ is a right angle, N$\hat{}$ = 61° and NT = 7.3 m

g) In ■PIG, P$\hat{}$ is a right angle, PI = 3.25 and GI = 5.75

h) In ■HOP, P$\hat{}$ is a right angle, O$\hat{}$ = 48° and OP = 165

Q-12 **Calculate the length of chord AB in each of the circles below.**

a)

b)

c)

d)

Q-13 **Look at each triangle in turn. Do you understand where the side proportions come from? If not, then those members of your group who understand the triangle should help the other members to understand it as well.**

Q-14 **Now close your textbooks. Each member of the group should try to draw these triangles for themselves. Check one another's work and help one another to get the triangles right. It is very important to be able to draw these triangles correctly.**

Q-15 **Use the special triangles to find the values of each of the following. Give your answers in surd form, where necessary. Do not use a calculator!**

a) sin 0°

b) cos 0°

c) tan 0°

d) sin 30°

e) cos 30°

f) tan 30°

g) sin 45°

h) cos 45°

i) tan 45°

j) sin 60°

k) cos 60°

l) tan 60°

m) sin 90°

n) cos 90°

o) tan 90°

Q-16 **Use your answers to question 3 to answer each of the following questions. You may use a calculator to convert the fractions to decimals, as these will be easier to compare.**

a) What do you notice about the values of the sine of an angle, as the angle increases from 0° to 90°?

b) What do you notice about the values of the cosine of an angle, as the angle increases from 0° to 90°?

c) What do you notice about the values of the tangent of an angle, as the angle increases from 0° to 90°?

d) What do you notice about tan 90°?

Q-17 **Work on your own and construct a right-angled triangle with acute angles of 45° each. By measuring the appropriate sides, calculate each of the following. Round your answers off to two decimal places.**

a)(i) sin 45°

(ii) cos 45°

(iii) tan 45°

b)(i) sin 45°

Q-18 **Work on your own and construct a right-angled triangle with acute angles of 60° and 30°. By measuring the appropriate sides, calculate each of the following. Round your answers off to two decimal places.**

a)(i) sin 60°

(ii) cos 60°

(iii) tan 60°

(iv) sin 30°

(v) cos 30°

(vi) tan 30°

b)(i) sin 60°

Q-19 **In your groups, discuss your findings in questions 5 and 6.**

a) If some group members found answers that were not close to the correct approximate answers, help them by checking their constructions, measurements and calculations.

b) Use the special triangles to double-check the approximate values given in questions 5b) and 6b). Do you agree with these values?

Q-20 **Simplify each of the following without using trigonometric tables or a calculator. Give your answers in surd form, where applicable.**

a) $\cos 60° - \sin 30°$

b) $\sin^2 45° + \cos^2 45°$

c) $(\sin 45° + \cos 45°)^2$

d) $\tan^2 60° + \tan^2 45° + \tan^2 30°$

e) $\sin 60° / \sin 45°$

f) $(1 / \cos 30°)(1 / \cos 45°)(1 / \cos 60°)$

g) $2 \cos 30° \sin 30° + \sin 60° \sin 90°$

h) $\cos 30° \tan 45° \sin 30°$ _____ $\sin 60°$

i) $\sin 45° \tan^2 60° / \cos 45°$

j) $\tan^2 60° - 2 \sin 30° \cos 60° + 2 \cos^2 45° \cos 0°$

Q-21 **For each of the following points, calculate the values of (i) sin θ, (ii) cos θ and (iii) tan θ with the aid of a diagram, if θ is the angle between the line OP and the positive x axis.**

a) P(8; 15)

b) P(–24; 7)

c) P(6; –8)

d) P(–5; –12)

Q-22 **Given that sin θ = –48/50 and 0° $\leq \theta \leq$ 270°.**

a) Draw a diagram to show this information.

b) (i) cos θ

(ii) tan θ

c) Prove by calculation that $\tan \theta = \sin \theta / \cos \theta$.

d) Prove by calculation that $\sin^2 \theta + \cos^2 \theta = 1$.

Q-23 **Use a diagram to find the values of tan θ and sin θ if cos θ = 40/41 and 90° $\leq \theta \leq$ 360°.**

a) tan θ

b) sin θ

Q-24 **You will need a compass and a protractor.**

a) Draw a system of axes and construct a circle with the midpoint at the origin and a radius of 10 cm.

b) Divide each quadrant of the Cartesian plane into intervals of 30°.

c) Copy the table provided; for each point on the circumference corresponding to an angle, measure its (x,y) coordinates, divide by 10 and round to two decimal places to find cos θ and sin θ.

Q-25 **You will need a sheet of graph paper for 0° $\leq$ x $\leq$ 360°.**

a) Draw a system of axes and divide the x-axis into 30° intervals.

b) Plot the 13 sine coordinate pairs: (0°;0), (30°;0.5), …, (360°;0).

c) Join the points with a smooth curve to form the graph of y = sin x.

Q-26 **Draw the graph of y = cos x for 0° $\leq$ x $\leq$ 360° on new graph paper.**

a) Draw axes with x divided into 30° intervals and choose a suitable y■scale.

b) Plot the 13 cosine coordinate pairs for the same angles.

c) Join the points with a smooth curve to form the graph of y = cos x.

Q-27 **Use your graphs and/or table to answer the following.**

a) What is the minimum value of sin x?

b) What is the maximum value of sin x?

c) What is the minimum value of cos x?

d) What is the maximum value of cos x?

Q-28 **Use the sine and cosine graphs above to find the values of:**

a) sin 0°

b) sin 90°

c) sin 180°

d) sin 270°

e) sin 360°

f) cos 0°

g) cos 90°

h) cos 180°

i) cos 270°

j) cos 360°

Q-29 **Use the sine and cosine graphs above to find the value(s) of x for which:**

a) sin x = 0

b) sin x = 1

c) sin x = –1

d) cos x = 0

e) cos x = 1

f) cos x = –1

Q-30 **Study the sine and cosine graphs above. Between which two values of x is:**

a) sin x > 0?

b) sin x < 0?

c) cos x < 0?

Q-31 **A 15 m ladder is set against a wall. It makes an angle of 70° with the ground.**

a) Draw a diagram of this situation, showing all the given information.

b) How far up the wall does the ladder reach?

c) How far is the foot of the ladder from the wall?

Q-32 **This road sign says that the gradient of the slope is 4% or 2 in 50. Calculate the angle that the slope makes with the horizontal.**

a) Calculate the angle that the slope makes with the horizontal.

Q-33 **A flagpole with a height of 7.5 m is supported by a 10 m wire that anchors the top of the pole to the ground.**

a) Draw a diagram of this situation, showing all the given information.

b) Calculate the angle between the wire and the ground.

c) Calculate the distance on the ground between the foot of the pole and the wire.

Q-34 **A land surveyor needs to find the distance between X and Y on opposite sides of the banks of a river. He walks along the river bank from point Y and finds another point Z such that ∠XZY = 30° and YZ = 61 m. Calculate the distance between X and Y.**

a) Calculate the distance between X and Y.

Q-35 **A tree casts a shadow of 15 metres. A beetle is on the ground at the tip of the shadow. If the angle of elevation from the beetle to the top of the tree is 29°, calculate the height of the tree, correct to the nearest centimetre.**

Q-36 **In the diagram below, a fishing boat B is fishing off the coast of Nigeria. The boat is directly above point P, which is on the ocean bed. A fisherman F is standing on the shore, 10 km away from the boat. The angle of depression from the fisherman to point P is 4°. How far below sea level is point P? Give your answer to the nearest metre.**

Q-37 **A game ranger is walking directly towards a vertical cliff. At point A she sees an eagle on a ledge of the cliff. The angle of elevation from the game ranger to the eagle is 22.3°. The game ranger walks directly towards the cliff for a distance of 500 m. The angle of elevation from her new position to the eagle is now 31.8°.**

a) Explain what each of the points B, C and D represent.

b) How far is point A from the foot of the cliff directly below the eagle? Give your answer to the nearest metre. (Hint: Let DC = y and BC = x, then set up two equations in terms of the given information. Solve the equations simultaneously.)

c) How high above the ground is the eagle? Give your answer to the nearest metre.

Q-38 **In the diagram, three hikers, shown by points A, B and C, are walking in a straight line. Directly in front of them is a mast MS. The three hikers are all 10 m apart and the front hiker (at point C) is 20 m from the mast. The angle of elevation from the spot where the front hiker is to the top of the mast is 45°.**

a) What is the height of the mast?

b) Calculate the angle of depression from the top of the mast to the spot where the second hiker is.

c) Calculate the angle of elevation from the spot where the last hiker is to the top of the mast.

Q-39 **Do this exercise as a group activity. Use the illustration of a compass while you discuss and answer the following questions. What compass point is indicated by each of these bearings?**

a) 000°

b) 270°

c) 135°

Q-40 **Write the bearing of each of these compass points:**

a) S

b) NE

c) SW

Q-41 **A woman and her husband go jogging. In the diagram you will see that the man jogs from their home H in a straight line on a bearing of 045°. His wife jogs from their home in a straight line on a bearing of 135°. They both jog at an average speed of 4.5 km/h. After jogging for 20 minutes, they both stop. The man is at point M and his wife is at point W. They turn and jog in a straight line towards one another at an average speed of 4.5 km/h.**

a) For how long did each of them jog altogether? Give your answer to the nearest minute.

b) How far did each of them jog in total?

Q-42 **In the diagram alongside, Towns A, B and C form a triangle. Town B is on a bearing of 70° from Town A, Town C is on a bearing of 210° from Town B and Town A is on a bearing of 340° from Town C. The distance from Town A to Town B is 150 km.**

a) Calculate the size of ∠ABC.

b) Calculate the size of ∠ACB.

c) Calculate the size of ∠BAC.

d) Calculate the distance from Town B to Town C.

e) Calculate the distance from Town A to Town C.

Q-43 **In the diagram below, a boat leaves a jetty J and sails 30 km on a bearing of 330°. It then turns at point A and sails on a bearing of 060° for 40 km, to point B.**

a) What is the bearing of the boat from the jetty at point B?

b) How far is the boat from the jetty at point B?

Chapter-11 Topic 11 Logical reasoning

Q-1 **In ■Exercise 11.1 Question 1: Say whether or not each of the following are statements.**

a) Taraba is a region in Nigeria.

b) Where do you live?

c) A pentagon has seven sides.

d) Our Chemistry teacher is getting married.

e) Three plus four equals seven.

f) If we mix yellow and blue paint, we get white paint.

g) The city of Lagos.

h) 40 – 19 = 21

i) Close the door!

j) She likes Mathematics.

Q-2 **Write down the letters of the statements in question 1 that are true.**

Q-3 **Write down the letters of the statements in question 1 that are false.**

Q-4 **Write down the letters of the statements in question 1 that might be true or false.**

Q-5 **Copy and complete the table below by putting a tick in the correct block. The first three have been done for you.**

Q-6 **For each of the following open statements, give possible values for the variables that will make the statement (i) true and (ii) false.**

a) $5x - 3 = 7$

b) $6p = -42$

c) $3a > 27$

d) $y = \sqrt{x}$

e) $4x = 2x$

f) $y = x + 4$

g) $y = 3x - 11$

h) $x\blacksquare = x$

Q-7 **Write the negation of each of the following statements.**

a) My best friend's name is Abeo.

b) Benin shares a border with Nigeria.

c) $17 - 5 \neq 12$

d) Lake Chad is completely inside Nigeria.

e) $\blacksquare \subset \blacksquare$

f) $-30 \leq -31$

Q-8 **Write the negation of each of the following statements.**

a) Some students enjoy sport.

b) All adults have bank accounts.

c) Some dogs do not chase cats.

d) No children like spinach.

Q-9 **For each of the following statements, more than one negation statement is given. Write down the numbers of each valid negation statement.**

a) P: We will go on holiday after May. ~P: (i) We will go on holiday before May. (ii) We will not go on holiday after May. (iii) It is not true that we will go on holiday after May. (iv) We will go on holiday during or before May.

b) P: Damilola and Bolaji are brothers. ~P: (i) It is not true that Damilola and Bolaji are brothers. (ii) Damilola and Bolaji are sisters. (iii) Damilola and Bolaji are not related. (iv) Damilola and Bolaji are not brothers.

c) P: Zainab is the youngest student in the class. ~P: (i) Zainab is the oldest student in the class. (ii) Zainab is not the youngest student in the class. (iii) Zainab is the second-youngest student in the class. (iv) It is not true that Zainab is the youngest student in the class. (v) Zainab is not a student in the class.

d) P: Some people enjoy horror movies. ~P: (i) Some people do not enjoy horror movies. (ii) All people enjoy horror movies. (iii) No people enjoy horror movies. (iv) All people do not enjoy horror movies.

Q-10 **Given: $P \wedge Q$.**

a) What kind of compound statement is this?

b) Under what conditions is $P \wedge Q$ true?

c) Under what conditions is $P \wedge Q$ false?

Q-11 **Find the truth value of $P \wedge Q$ for each of the following pairs of statements.**

a) P: Dogs can bark. Q: 4 + 3 = 8

b) P: 23 = 6 Q: The diameter of a circle is half the length of its radius.

c) P: It is possible for a right-angled triangle to be isosceles. Q: A triangle has four sides.

d) P: 2 < 7 Q: The product of 2 and 7 is 14.

e) P: The sea is not salty. Q: A cube is a prism.

f) P: 15 is a multiple of 3. Q: –3 > –15

Q-12 **Given the following statements: P: x > y Q: xy = 20**

a) Assign any integer values between 1 and 10 to x and y in such a way that $P \wedge Q$ is true.

b) Assign any integer values between 1 and 10 to x and y in such a way that $P \wedge Q$ is false.

Q-13 **Given: P $\vee$ Q.**

a) What kind of compound statement is this?

b) Under what conditions is P $\vee$ Q true?

c) Under what conditions is P $\vee$ Q false?

Q-14 **Find the truth value of P $\vee$ Q for each of the following pairs of statements:**

a) P: Pigs can fly. Q: Water is wet.

b) P: Friday comes just before Sunday. Q: December is the shortest month of the year.

c) P: 30 ÷ 6 = 5. Q: Ice is a form of water.

d) P: There are 100 mm in 1 cm. Q: A yam is a vegetable.

e) P: 100 is a power of 10. Q: –4 > –3.

f) P: A dog can have kittens. Q: Water freezes when it boils.

Q-15 **Given the following statements: P: x > y; Q: x + y = 11**

a) Assign any integer values between 1 and 10 to x and y in such a way that P $\vee$ Q is true.

b) Assign any integer values between 1 and 10 to x and y in such a way that P $\vee$ Q is false.

Q-16 **Given: P $\Rightarrow$ Q.**

a) What kind of compound statement is this?

b) Under what conditions is P $\Rightarrow$ Q true?

c) Under what conditions is P $\Rightarrow$ Q false?

Q-17 **In the statement 'If she saves her money, she will be able to buy a new bicycle', write down the:**

a) antecedent

b) consequent

Q-18 **Find the truth value of P $\Rightarrow$ Q for each of the following pairs of statements:**

a) P: 81 is a power of 3. Q: 3 is a factor of 81.

b) P: 3 is a factor of 24. Q: 24 is a power of 3.

c) P: ■1 = 100 Kobo. Q: 300 Kobo is worth ■3.

d) P: 5 ≤ 3. Q: The product of 8 and 3 is 24.

e) P: 8 < 7. Q: The sum of 7 and 8 is 51.

f) P: The earth has a magnetic North pole. Q: North is opposite East.

Q-19 **Given: P $\Leftrightarrow$ Q.**

a) What kind of compound statement is this?

b) Under what conditions is P $\Leftrightarrow$ Q true?

c) Under what conditions is P $\Leftrightarrow$ Q false?

Q-20 **Find the truth value of P $\Leftrightarrow$ Q for each of the following pairs of statements.**

a) P: The Sun rises in the East. Q: The Sun sets in the West.

b) P: Hausa is spoken in Nigeria. Q: Yoruba is not spoken in Nigeria.

c) P: 5 is a factor of 20. Q: 20 is a multiple of 5.

d) P: April is the first month of the year. Q: March is the last month of the year.

e) P: 2 + 2 = 5. Q: 5 + 5 = 10.

f) P: A is the first letter of the alphabet. Q: All first names begin with an A.

Q-21 **What does each of the following symbols mean?**

a) ~

b) $\wedge$

c) $\vee$

d) $\Rightarrow$

e) $\Leftrightarrow$

Q-22 **Draw up a truth table for P and ~P. (Hint: Your table will have only two columns: one for P and one for ~P.)**

Q-23 **Given the statements P: 'it is cold' and Q: 'the wind is blowing', 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 $\Rightarrow$ ~Q

Q-24 **Given the statements P: 'she is kind' and Q: 'she is clever', write each of the following in logical notation, using P and Q.**

a) She is not kind.

b) She is not clever.

c) She is kind and clever.

d) She is kind and not clever.

e) She is clever and not kind.

f) She is not kind and not clever.

g) She is kind or clever.

h) If she is kind, then she is clever.

i) If she is clever, then she is not kind.

j) She is kind if and only if she is clever.

Q-25 **Find the truth value of each of the following compound statements.**

a) If 3 + 2 = 7, then 7 + 2 = 9.

b) 8 + 8 = 10 if and only if 4 + 4 = 5.

c) 1 + 1 = 3 or 1 + 2 = 3.

d) 6 – 1 = 5 and 5 – 6 = 1.

e) If 1 < 4, then –1 < –4.

Chapter-12 Topic 12 Mensuration: Solids

Q-1 **Calculate the area of the rectangular prisms that have the measurements provided.**

a) breadth = 12 mm, height = 10 mm, length = 15 mm

b) breadth = 6.1 cm, height = 2.7 cm, length = 8.3 cm

c) breadth = 22 mm, height = 3.1 cm, length = 45 mm

d) breadth = 2 m, height = 150 cm, length = 75 cm

Q-2 **Calculate the area of a triangular prism with the following measurements. Note that the cross-section is an isosceles triangle.**

a) breadth = 30 mm, ■ height = 20 mm, length = 36 mm

b) breadth = 10 cm, ■ height = 12 cm, length = 16 cm

c) breadth = 14 cm, ■ height = 24 cm, length = 30 cm

d) breadth = 1.6 m, ■ height = 150 cm, length = 200 cm

Q-3 **Calculate the area of a square-based pyramid with the following measurements.**

a) side of square = 16 cm, slant height = 24 cm

b) side of square = 60 mm, ■ height = 40 mm

c) side of square = 10 cm, ■ height = 12 cm

d) side of square = 32 mm, ■ height = 30 mm

Q-4 **Calculate the area of the cuboid.**

Q-5 **Calculate the area of the triangular prism.**

a) sides of triangular cross-section = 18 cm, 14 cm, 15 cm

Q-6 **A triangular prism has area 816 cm². If each side of the equilateral triangle is 12 cm, calculate the length of the prism.**

Q-7 **Determine the side of a cube with area 73.5 cm².**

Q-8 **A square-based pyramid has an area of 144 cm². Calculate the perpendicular height of the pyramid if each side of the base is 8 cm.**

Q-9 **Twenty-seven cubes fit exactly inside a cubical container without a lid. How many of the cubes are touching the sides or bottom of the container?**

Q-10 **Calculate the total surface area of the house drawn below. The doorway is square.**

Q-11 **Calculate the area of a cylinder with the following measurements.**

a) r = 3 cm and h = 12 cm

b) r = 4.5 cm and h = 16.2 cm

c) d = 12 mm and h = 22 mm

d) r = 16 mm and h = 3.1 cm

Q-12 **Calculate the area of a cone with the following measurements.**

a) r = 9 cm and s = 15 cm

b) r = 7 mm and ■ h = 24 mm

c) d = 10 cm and s = 26 cm

d) d = 16.8 cm and ■ h = 12.3 cm

Q-13 **Calculate the area of the cone.**

a) 19 mm

b) 47 mm

Q-14 **Calculate the area of the cylinder.**

a) 45 mm

b) 6 cm

Q-15 **Calculate the total surface area of the shape provided.**

Q-16 **Calculate the volume of a rectangular prism with the measurements given.**

a) breadth = 12 mm, height = 10 mm, length = 15 mm

b) breadth = 6.1 cm, height = 2.7 cm, length = 8.3 cm

c) breadth = 22 mm, height = 3.1 cm, length = 45 mm

d) breadth = 2 m, height = 150 cm, length = 75 cm

Q-17 **Calculate the volume of a triangular prism with the measurements given.**

a) base = 32 mm, height = 20 mm, length = 16 mm

b) base = 4.1 cm, height = 4.5 cm, length = 6.2 cm

c) base = 83 mm, height = 6.1 cm, length = 58 mm

d) base = 1.2 m, height = 260 cm, length = 800 cm

Q-18 **Calculate the volume of a square■based pyramid with the measurements given.**

a) side of square = 32 mm, height = 30 mm

b) side of square = 60 mm, height = 40 mm

c) side of square = 10 cm, height = 12 cm

d) side of square = 14 cm, slant height = 25 cm

Q-19 **Calculate the volume of the triangular prisms.**

a) ∆ABC sides = 40 cm, 22 cm, 34 cm; length = 5 cm

b) ∆DEF sides = 9 cm, 6 cm

Q-20 **Calculate the volume of the square■based triangular prism with sides equal to 2 cm and height 3 cm.**

Q-21 **Calculate the volume of the triangular prism and write the answer in cm^3 correct to two decimal places.**

Q-22 **Calculate the volume of the cuboids below.**

a) 315 mm × 216 mm × 98 mm

b) 1.3 m × 1.6 m × 0.8 m

Q-23 **Calculate the height of the rectangular prism with volume 34.72 m^3, length = 3.1 m and breadth = 7 m.**

Q-24 **Determine the volume of the rectangular■based triangular pyramid if the measurements are in metres.**

Q-25 **The shape alongside consists of a triangular■based pyramid on top of a triangular prism. The prism has height 42 cm and the pyramid has height 12 cm. Each side of the equilateral triangle base is 20 cm. Calculate the total volume of the solid.**

Q-26 **Calculate the volume of a cylinder with the following measurements.**

a) r = 5 cm and h = 10 cm

b) r = 4.2 m and h = 11.6 m

c) d = 8 mm and h = 26 mm

d) d = 16.4 cm and h = 12.5 cm

Q-27 **Calculate the volume of a cone with the following measurements.**

a) r = 7 mm and ■h = 24 mm

b) r = 12 cm and s = 15 cm

c) d = 20 mm and s = 26 mm

Q-28 **Find the length of a cylinder with volume 190 cm^3 and radius 5 cm. Write the answer correct to one decimal place.**

Q-29 **Determine the volume of the cylinder.**

Q-30 **Calculate the volume of the cone.**

a) 19 mm

b) 47 mm

Q-31 **Find the volume of the shape below.**

a) 10 m

b) 12 m

c) 8 m

Q-32 **Calculate the volume of the shape below.**

Q-33 **Calculate the curved surface area of the frustrum of a cone with the following dimensions (all in cm).**

a) r = 3, R = 6, h = 8

b) r = 4, R = 6, h = 5

c) r = 2, R = 6, h = 9

Q-34 **A cone has the top part cut off as shown in the diagram alongside. Calculate:**

a) the vertical height of the small cone on top

b) the curved surface area of the frustrum

Q-35 **The top of a square-based pyramid is cut off. The base of the smaller pyramid has side length 3 cm and the vertical height of the frustrum is 6 cm. Calculate:**

a) the vertical height of the original pyramid

b) the total surface area of the original pyramid

c) the total surface area of the frustrum

Q-36 **The square based frustrum of a pyramid has base side lengths 18 cm and top side lengths 9 cm. All sloping sides have length 14 cm. Calculate the surface area of the frustrum (excluding the base).**

Q-37 **Calculate the curved surface area of the frustrum with r = 5 cm, R = 7.5 cm and vertical height of the frustrum = 15 cm.**

Q-38 **Calculate the curved surface area of the frustrum with r = 4 cm, R = 10 cm and vertical height of the frustrum = 15 cm.**

Q-39 **Calculate the volume of the frustrum (bottom part) of a cone with the following dimensions all measured in centimetres.**

a) r = 3, R = 6, h = 8

b) r = 4, R = 8, h = 5

c) r = 2, R = 10, h = 9

Q-40 **The frustrum and the truncation of the same pyramid are shown. Calculate:**

a) the height of the frustrum

b) the volume of the small pyramid

c) the volume of the original pyramid

d) the volume of the truncated pyramid

Q-41 **The top part of a cone is cut off. The radius of the top part is 4 cm and the radius of the base is 12 cm. The vertical height of the frustrum is 15 cm. Calculate:**

a) the vertical height of the top part of the cone

b) the volume of the top part of the cone

c) the volume of the frustrum

Q-42 **The top of a square-based pyramid is cut off. The base of the smaller pyramid has side length 3 cm and the vertical height of the frustrum is 6 cm. Calculate:**

a) the vertical height of the original pyramid

b) the volume of the frustrum

Q-43 **Calculate the volume of the frustrum with r = 5 cm, R = 7.5 cm and vertical height of the frustrum = 15 cm.**

Q-44 **Calculate the volume of the square-based frustrum of a pyramid with top side = 9 cm, base side = 18 cm and sloping side = 14 cm.**

Q-45 **Calculate the volume required to make a bucket if the top radius is 30 cm and the bottom radius is 18 cm. The depth of the bucket is 16 cm.**

Q-46 **The top of a cone is cut off and a cylindrical hole is cut out of the frustrum. Calculate:**

a) the perpendicular height of the cone on the top

b) the volume of the cone on top

c) the volume of the original cone

d) the volume of the frustrum

e) the volume of the cylindrical hole

f) the volume of the remaining truncated cone

Chapter-13 Topic 13 Constructions

Q-1 **Construct and verify bisector of CD**

a) Draw a line of 10 cm and label endpoints C and D.

b) Bisect CD.

c) Measure your partner's lines and confirm each half is 5 cm.

Q-2 **Construct and verify bisector of JK**

a) Draw a line of 7 cm and label endpoints J and K.

b) Bisect JK.

c) Measure your partner's lines and confirm each half is 3.5 cm.

Q-3 **Construct and verify bisector of ST**

a) Draw a line of 84 mm and label endpoints S and T.

b) Bisect ST.

c) Measure your partner's lines and confirm each half is 42 mm.

Q-4 **Construct and bisect angles in ∠ABC.**

a) Construct ∠ABC = 90°

b) Bisect ∠ABC to give ∠DBC = 45°

c) Bisect ∠DBC to give ∠EBC = 22.5°

Q-5 **Use a protractor to measure and label your partner's angles from question 1.**

Q-6 **Construct and bisect angles in ∠PQR.**

a) Construct ∠PQR = 60°

b) Bisect ∠PQR to give ∠SQR = 30°

c) Bisect ∠SQR to give ∠TQR and measure ∠TQR

Q-7 **Use a protractor to measure and label your partner's angles from question 3.**

Q-8 **With your partner, discuss the previous example in which an angle of 60° was used to construct an angle of 120°. Explain how you would adapt this idea to construct an angle of 150° or of 135°.**

Q-9 **Construct and bisect angles in ∠KLM.**

a) Construct ∠KLM = 150°

b) Bisect ∠KLM to give ∠NLM

c) Measure ∠NLM

Q-10 **Use a protractor to measure your partner's angles in question 2. Make sure that all the angles are labelled correctly and that the measurements are correct.**

Q-11 **Construct and bisect angles in ∠QRS.**

a) Construct ∠QRS = 135°

b) Bisect ∠QRS to give ∠TRS

c) Measure ∠TRS

Q-12 **Use a protractor to measure your partner's angles in question 4. Make sure that all the angles are labelled correctly and that the measurements are correct.**

Q-13 **Construct ■DEF with DE = EF = DF = 7.5 cm.**

a) Measure ∠D, ∠E and ∠F

b) What kind of triangle is ■DEF?

Q-14 **Construct ■ABC with AB = 10 cm, BC = 8 cm and AC = 6 cm.**

a) Measure ∠A, ∠B and ∠C

b) What kind of triangle is ■ABC?

Q-15 **Construct ■RST with ∠R = 135°, RS = 45 mm and RT = 45 mm.**

a) Measure ∠S, ∠T and ST

b) What kind of triangle is ■RST?

Q-16 **Construct ■XYZ with XY = 72 mm, ∠X = 75° and ∠Y = 30°.**

a) Measure ∠Z, YZ and XZ

b) What kind of triangle is ■XYZ?

Q-17 **Construct two different triangles such that ∠C = 45°, CD = 6 cm and DE = 4.5 cm.**

a) For each triangle, measure ∠D, ∠E and CE

b) What kind of triangle is each one?

Q-18 **Construct three different right-angled triangles with angles 90°, 60° and 30° and one side of 6 cm.**

a) Vary the placement of the 6 cm side to produce three distinct constructions

Q-19 **Construct ∠DEF = 75° with DE = EF = 7 cm; construct EG = 9 cm as the bisector of ∠DEF; join DG, FG and DF; mark H at EG∩DF; measure DG, FG, DH, FH and ∠DHG; identify quadrilateral DEFG.**

a) Construct ∠DEF = 75° with DE = EF = 7 cm.

b) Construct EG = 9 cm as the bisector of ∠DEF.

c) Join DG, FG and DF; mark H at EG∩DF.

d) Measure DG and FG.

e) Identify quadrilateral DEFG using side lengths.

f) Measure DH, FH and ∠DHG and explain.

Q-20 **Construct a circle of radius 4.5 cm; draw two diameters at 30° to one another meeting the circumference at P, Q, R, S; identify quadrilateral PQRS.**

a) Draw a circle of radius 4.5 cm.

b) Draw two diameters at 30°, meeting the circle at P, Q, R, S.

c) Identify quadrilateral PQRS using measurements.

Q-21 **Construct parallelogram PQRS with ∠P = 45°, PQ = 5 cm, PS = 8 cm; bisect all angles; let A, B, C, D be intersections of bisectors; identify quadrilateral ABCD.**

a) Construct PQRS as given.

b) Bisect ∠P, ∠Q, ∠R, ∠S.

c) Mark intersection of adjacent bisectors as A, B, C, D.

d) Identify quadrilateral ABCD using measurements.

Q-22 **Mark points A, B with AB = 6 cm; draw circles centre A, B radius 5 cm; let C, D = intersections; join AC, BC, BD, AD; identify quadrilateral ACBD.**

a) Mark A, B 6 cm apart.

b) Draw circles centre A and B, radius 5 cm.

c) Let C, D be intersections; join AC, BC, BD, AD.

d) Identify quadrilateral ACBD using measurements.

Q-23 **Construct ■XYZ with XY = XZ = 7 cm, YZ = 3.5 cm; construct midpoints M of XY and N of XZ; extend MN to P so MN = NP; identify quadrilateral MPZY.**

a) Construct ■XYZ as given.

b) Construct M, N midpoints; extend to P so MN = NP.

c) Identify quadrilateral MPZY using measurements.

Q-24 **Draw any circle; choose four points A, B, C, D on circumference; join AB, BC, CD, DA; measure ∠A, ∠B, ∠C, ∠D; state sums of ∠A+∠C and ∠B+∠D; conclude about opposite angles.**

a) Draw circle; mark A, B, C, D on circumference.

b) Join AB, BC, CD, DA.

c) Measure ∠A, ∠B, ∠C, ∠D.

d) Compute ∠A+∠C and ∠B+∠D.

e) Conclude relationship of opposite angles.

Q-25 **Given a circle with centre C and radius 6 cm. The locus of point P is outside the circle, exactly 2 cm from the circumference.**

a) Construct circle C and the locus of P (dotted) and show three possible positions of P.

b) Describe the locus of P.

Q-26 **Given line AB = 4 cm. The locus of point P is exactly 1 cm from line AB.**

a) Construct line AB and the locus of P (dotted) and show four possible positions of P.

b) Describe the locus of P.

Q-27 **Construct ∠PQR = 60° with PQ = QR = 6 cm. The locus of point P is equidistant from lines PQ and QR.**

a) Construct ∠PQR and sides PQ, QR.

b) Construct the locus of P (dotted) and show three possible positions of P.

c) Describe the locus of P.

Q-28 **Construct any ■ABP. The locus of point P is such that the area of ■APB remains constant.**

a) Construct ■ABP.

b) Construct the locus of P (dotted) and show three possible positions of P.

c) Describe the locus of P.

Q-29 **Construct any square ABCD. The locus of point P is within the square and equidistant from vertices A and C.**

a) Construct square ABCD.

b) Construct the locus of P (dotted) and show three possible positions of P.

c) Describe the locus of P in terms of vertices A and C.

Q-30 **LM is a horizontal line segment; point N is above LM. Construct and describe the locus of N if ■LMN is isosceles (LN = MN), equilateral, and right-angled at L.**

a) For isosceles (LN=MN), construct LM and locus of N; show possible N.

b) For equilateral, construct locus of N; show possible N.

c) For right-angled at L, construct locus of N; show possible N.

Q-31 **Construct ■XYZ with XY = 6 cm, ∠Y = 135° and YZ = 5 cm; bisect XZ at M; construct a circle centre M, radius 3 cm. The locus of P lies within ■XYZ but outside the circle.**

a) Construct ■XYZ and bisect XZ to find M.

b) Draw circle centre M, radius 3 cm.

c) Shade the region(s) within ■XYZ but outside the circle to represent the locus of P.

Q-32 **Given points X and Y. The locus of P is always 4 cm from X; the locus of Q is always 6 cm from Y.**

a) Describe the loci of P and Q.

b) If the loci touch but do not overlap, determine the distance XY and illustrate.

c) If the loci do not touch or overlap, describe all possible distances XY and illustrate.

Chapter-14 Topic 14 Triangles, parallel lines, parallelograms

Q-1 **Name the type of angles shown in each of the diagrams.**

a)

b)

c)

d)

Q-2 **Calculate the size of each angle marked with an arc.**

a)

b)

c)

d)

Q-3 **Find the values of x and y.**

a) x

b) y

Q-4 **Find the values of the unknown angles.**

a)

b)

c)

d)

e)

f)

g)

h)

Q-5 **If 85° and t are complementary angles, find t; if 65° and t are supplementary angles, find t; if 55° and t are vertically opposite angles, find t.**

a) complementary t

b) supplementary t

c) vertically opposite t

Q-6 **State, giving reasons, the relationship between:**

a) c and d

b) x and y

Q-7 **Which of the following statements is/are true when two straight lines intersect?**

a) adjacent angles are supplementary

b) adjacent angles are equal

c) vertically opposite angles are equal

d) vertically opposite angles are supplementary

Q-8 **Calculate the unknown values of the angles in the triangles below.**

a)

b)

c)

d)

Q-9 **Calculate the angles that are labelled by letters in the triangles below.**

a)

b)

c)

Q-10 **Calculate the values of x, y and z in each triangle.**

a)

b)

c)

d)

e)

Q-11 **State the condition of congruency that supports the argument that ∆PQR is congruent to ∆WXY in each case listed below.**

a) P$\hat{}$ = W, PQ = WX, PR = WY

b) PQ = WX, QR = XY, RP = YW

c) QP = XW, Q$\hat{}$ = X, QR = XY

Q-12 **In each case, write out the condition for which the abbreviation stands.**

a) SAS

b) RHL

c) AAS

Q-13 **Use the diagrams to answer the questions that follow.**

a) Name the two congruent triangles.

b) Give a reason for your answer.

Q-14 **If BQ = QC and PQ = QR, prove that these triangles are congruent.**

a) ∆PQB and ∆RQC

b) ∆ABR and ∆ACP

Q-15 **Use the diagram below and the properties listed to complete the sentences: vertically opposite, corresponding, supplementary, alternate interior, exterior.**

a) Angles b and c are ___ angles.

b) Angles f and e are ___ angles.

c) Angles a and e are ___ angles.

d) Angles d and h are ___ angles.

e) Angles c and d and g and h are ___ angles.

f) Angles a and f and e and b are ___ angles.

Q-16 **Given that l■ and l■ are parallel lines, calculate the angles that are labelled with letters.**

Q-17 **Determine the size of the angles marked a to d in the diagrams below.**

a)

b)

c)

d)

Q-18 **In the diagram below, ∠TQS = ∠Q■R. Prove that ∠PQT = ∠P■QR.**

Q-19 **In the figure, lines AB, DB, CB and EB all meet at B. ∠ABC = ∠DBE = 90°. Prove that PB ■ PE.**

Q-20 **Given ■CDE ≡ ■FCG, prove that DE || FG**

Q-21 **If AB = 5 cm, BC = 6 cm and AD = 6 cm, what is the length of EF?**

Q-22 **In the diagram ∆LBC, find AF if AD = 6, DB = 4 and CE = 5.**

Q-23 **Calculate CN in the diagram alongside if FA and CN are parallel.**

Q-24 **Calculate length WV in ∆STU.**

Q-25 **Find lengths IJ and KJ in the diagram below if HI = 13 cm, HJ = 16 cm, LJ = 4.5 cm and KL = 6.5 cm.**

Q-26 **Lewa holds her arm in front of her so that her hand is one metre from her body. The height of her hand is 5 cm and it can hide a 400 m high mountain far away. How far is she from the mountain?**

Q-27 **If LM ■ JK, calculate y.**

Q-28 **Given ∠EDH with ED = 36, EG = 42, GH = 21 and GF = 15, find GF.**

Q-29 **In ∆ABF, AD ■ DC, AC ■ DE, AD = 8, DF = 12, AB = 15 and BF = 25, calculate BC, CE, CD, CE, DF and the ratio DE : AF.**

Q-30 **Calculate angles for regular polygons**

a) What is the measure of one exterior angle of a pentagon?

b) What is the measure of one interior angle of a regular octagon?

c) What is the size of one of the angles at the centre of a regular hexagon?

Q-31 **Calculate for regular hexagon**

a) the sum of the interior angles of the regular hexagon

b) the size of one of the interior angles

Q-32 **Identify polygon from exterior angle**

a) 18°

b) 45°

c) 6°

Q-33 **Identify polygon from interior angle**

a) 150°

b) 162°

c) 156°

Q-34 **Given the diagram below**

a) Solve for x.

b) Prove that MNPQ is a parallelogram.

Q-35 **Given the diagram below**

a) In the diagram, HGJE is a parallelogram with DH = JF and ∠DGH = ∠FEJ. Prove that DEFG is a parallelogram.

Q-36 **Given quadrilateral ABPC**

a) ∠AOB = ∠POC

b) ABPC is a parallelogram.

Chapter-15 Topic 15 Statistics

Q-1 **For each of the following data sets, calculate: (i) the mean (ii) the median (iii) the mode (iv) the range**

a) {3, 8, 9, 17, 35, 38, 39, 42, 44}

b) {24, 60, 33, 60, 24, 94, 70, 57, 84, 81, 97, 42, 31, 56}

c) {–13, 4, 11, –16, 18, 5, –7, 3, 5, –7, –23, 10, 14}

d) {7.6, –5.2, 7.5, 5.9, –8.5, 5.1, –1.1, 8.8, 7.5, 9.9, 0.3, 8.4}

Q-2 **In a History test out of 50 marks, the median score was 28. What does this statistic tell the teacher?**

Q-3 **In a Geography test out of 50 marks, the range was 42. What does this statistic tell the teacher?**

Q-4 **For a school project, an SS1 student wrote down the different types of vehicles that drove past her house one Saturday morning, using the key B = Buses, C = Cars, T = Taxis and O = Other. Summarise this data in a frequency table.**

Q-5 **A teacher asked her students to estimate the number of glasses of water that they drink every day.**

a) Summarise this data in a frequency table.

b) Use your frequency table (not the original data) to calculate: (i) the mean (ii) the median (iii) the mode (iv) the range of this data.

c) What percentage of these students estimate that they drink at least four glasses of water per day?

Q-6 **Check each table against the raw data for the corresponding team and make sure that you agree with the numbers in the table.**

Q-7 **In which table is the least detail lost?**

Q-8 **In which table is the most detail lost?**

Q-9 **If the pass mark for the practical was 70%, which table(s) would show Ms Bakare how many students in the corresponding team(s) had passed the practical?**

Q-10 **Ms Bakare wants to know how many students in each team scored less than 10 out of 30 for the practical. Which table(s) will give her this information?**

Q-11 **The data values in a data set are integers that range from 45 to 84. Calculate a suitable class interval to use when grouping this data, and list the classes, if you group the data into:**

a) five classes

b) eight classes

Q-12 **The masses of the students in SS1 range from 56 kg to 108 kg. Calculate a suitable class interval to use when grouping this data, and list the classes, if you group the data into:**

a) six classes

b) seven classes

Q-13 **The heights of the people living in a village range from 0.36 m to 1.98 m. Calculate a suitable class interval to use when grouping this data, and list the classes, if you group the data into:**

a) four classes

b) eight classes

Q-14 **Copy and complete each of the tables below by calculating the class boundaries for each class.**

Q-15 **Copy and complete each of the tables below by calculating the midpoint of each class.**

Q-16 **The weekly numbers of tourists who visited the temple of the Yoruba goddess Oshun at Osun-Osogbo during one year are summarised in the table below.**

a) Use this frequency table to estimate, to the nearest whole number: (i) the mean (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-17 **The widths of 46 sugar cane leaves were measured in an experiment. The results are summarised in the table below.**

a) Use this frequency table to estimate, to the nearest millimetre: (i) the mean (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-18 **Nigeria shares land borders with the Republic of Benin in the west, Niger in the north and Chad and Cameroon in the east. The lengths of these borders are as follows: Benin 773 km, Niger 1 497 km, Chad 87 km and Cameroon 1 690 km.**

a) Calculate the total length of Nigeria's land borders.

b) Copy and complete the table below.

c) Represent this data in a pie chart.

Q-19 **The table below shows the population of the major cities of Nigeria.**

a) Calculate the total population of these eight cities.

b) Copy and complete the table below.

c) Represent the populations of these eight cities in a pie chart.

Q-20 **The manager of an animal shelter kept a record of abandoned animals that were brought to the shelter over a period of twelve months.**

a) Draw a line graph of this data.

b) The manager suspects that there may be a connection between the dates of the school holidays and the numbers of abandoned animals. Do you think that the manager may be correct? Discuss this in your group. Once your group has come to a conclusion, work on your own and write a few sentences explaining whether or not you agree with the manager. Give reasons to support your answer.

Q-21 **The figures for Nigeria's annual inflation rate for the years 2001 to 2014 are shown in the tables below.**

a) Draw a line graph of this data.

b) In which year was the inflation rate the highest?

c) In which year was the inflation rate the lowest?

d) Between which two consecutive years was the increase in the inflation rate the greatest?

e) Between which two consecutive years was the decrease in the inflation rate the greatest?

f) Comment on the overall trend that you see in your graph.

Q-22 **Refer to the second example above. Biola says that this compound bar graph clearly shows that the girls outperformed the boys. Is she correct? Support your answer by suitable calculations.**

Q-23 **A factory that manufactures energysaving light bulbs packs them in boxes of 36 light bulbs. Before these boxes leave the factory, they are tested at random and the number of defective light bulbs in each box that is tested is recorded. The results for the boxes that are tested in one week and found to contain defective light bulbs are as follows.**

a) How many boxes contained defective light bulbs?

b) If 500 boxes were tested that week, what percentage of those boxes contained defective light bulbs?

c) What does the '7+' in the table mean?

d) Display this data in a bar graph.

e) What was the most common number of defective light bulbs in the boxes represented in the table?

f) What was the most common number of defective light bulbs in the 500 boxes that were tested?

Q-24 **Nigeria has the highest population of any country in Africa and the seventh highest population in the world. The table below shows the ten countries with the highest populations in the world. It also shows the area of each country.**

a) Round the population of each country off to the nearest million.

b) Draw a bar graph of the populations of these ten countries.

c) Round the area of each country off to the nearest hundred thousand km2.

d) Draw a bar graph of the areas of these ten countries.

e) Calculate the population density of each country. Use the formula: Population density (in population/km2) = population ÷ area. Round your answers off to one decimal place.

f) Draw a bar graph of the population densities of these ten countries.

g) Compare the three bar graphs that you have drawn. What interesting facts do you notice about: (i) Russia (ii) Bangladesh?

Q-25 **Did you know that Nigeria is by far the world's largest producer of yams? A farmer weighed 50 of his yams, correct to the nearest 10 grams. These masses are summarised in the table below.**

a) Represent this data in a histogram.

Q-26 **A hospital in Lagos recorded the lengths of the new-born babies born at the hospital during a certain month. All the lengths were recorded to the nearest millimetre. These lengths are summarised in the table below.**

a) Explain what the notation (355, 385] means.

b) How many babies were born in the hospital during that month?

c) Represent this data in a histogram.

Q-27 **Draw a frequency polygon on the histogram that you drew in question 1 of Exercise 15.12.**

Q-28 **Draw a frequency polygon on the histogram that you drew in question 2 of Exercise 15.12.**