Question bank

Chapter-1 Topic 1: Revision

Q-1 **Write each number in expanded form.**

a) 2.45 × 10■

b) 7.013 × 10■■

c) 8.3137 × 10■

d) 6.48005 × 10■■

Q-2 **Write each number in standard form.**

a) 9 358

b) 0.00294

c) 135 290 000 000

d) 0.000000001836

Q-3 **Use the laws of indices to simplify the following. Write your answers with positive indices, where necessary.**

a) t■ × t

b) p■ ÷ p³

c) (ab■c■)■

d) (–1)■(vw■■)²

e) (x × y■■)■¹

f) a■ × a■■

g) 625^(2/4)

h) (8y■)^(2/3)

i) 8k■ × (8k)■ × (2k)■ ÷ 64(–2k)³

Q-4 **Write the following in index form.**

a) ■m

b) ■x■

c) √(2y³)

d) ■b■

Q-5 **Write the following in root form.**

a) k^(1/4)

b) (2ab)^(1/2)

c) x^(3/5)

d) p^(m/n)

Q-6 **Which numbers are rational and which are irrational? Give a reason for each answer.**

a) ¾

b) –0.85

c) π

d) √(25/16)

e) 0

f) 1.3

g) –√12

h) ■(–8)

Q-7 **On the number line, a/b and c/d are rational numbers with b ≠ 0 and d ≠ 0, and x lies halfway between a/b and c/d.**

a) Express x in terms of a, b, c and d.

b) Explain why x is also a rational number.

c) What does the above suggest about the set of rational numbers?

Q-8 **Which number patterns are arithmetic progressions, which are geometric progressions, and which are neither? If a number pattern is an arithmetic progression, give the first term and the common difference. If it is a geometric progression, give the first term and the common ratio.**

a) 13; 22; 31; 40; …

b) 1; 8; 27; 64; …

c) 200; 100; 50; 25; …

d) 6; –2; –10; –18; …

e) ½, ■, ¾, ■/■, …

f) 1; –3; 9; –27; …

Q-9 **Find the formula for the nth term of each arithmetic and geometric progression you identified in question 1. Give each answer in its simplest form.**

Q-10 **The first term of a geometric progression is 3 and the constant ratio is 2.**

a) Find the formula for the nth term of this geometric progression.

b) Which term is 2■?

c) Calculate the value of T■.

Q-11 **The sum of the first 8 terms of an arithmetic progression is 116 and the sum of its first 18 terms is −9. Find the first term and the constant difference of this arithmetic progression.**

Q-12 **The first term of a geometric progression is 10 and the constant ratio is 0.3.**

a) Explain why this geometric progression converges.

b) Calculate the sum to infinity of this geometric progression, correct to two decimal places.

Q-13 **Dubem wants to invest ■700 000 for three years. Bank A offers him 8.4% simple interest p.a., while Bank B offers him 8.1% compound interest p.a.**

a) How much interest will Dubem's investment earn if he invests his money at Bank A?

b) How much interest will Dubem's investment earn if he invests his money at Bank B?

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

Q-14 **If Dubem were borrowing the money (as opposed to investing it) at the rates given in question 1, which option should he choose? Give a reason for your answer.**

Q-15 **If the value of a bus depreciates by a fixed rate per annum and it takes five years for the value of the bus to halve, give the rate of depreciation.**

Q-16 **If 1 kg of oranges costs ■300 and the inflation rate is constant at 7.9% p.a., what will 1 kg of oranges cost in four years' time?**

Q-17 **Make d the subject of the formula $S = n/2 \times [2a + (n - 1)d]$.**

Q-18 **Make r the subject of the formula $S_\infty = a/(1 - r)$.**

Q-19 **Make r the subject of the formula $A = P(1 - r/100)^■$.**

Q-20 **Make y the subject of the formula $x^2 + y^2 = r^2$.**

Q-21 **Make r the subject of the formula $V = 4/3\ \pi r^3$.**

Q-22 **Make n the subject of the formula A = P(1 + r/100)■.**

Q-23 **Make n the subject of the formula T■ = ar■■¹.**

Q-24 **Solve the equations.**

a) $4(2x – 9) + 6 = 10 – (12 – x)$

b) $(3x – 8)/3 = (5x + 7)/6 – 5$

c) $3 + (4x + 1)/4 = (8 + 5x)/5$

d) $5/x + 12 – 8/(3x) = (2x – 3)/(3x)$

e) $(x + 8)/(x – 5) = (x – 8)/(x + 2)$

f) $(x + 4)/(x – 3) = (x – 3)/(x + 6)$

Q-25 **Factorise each expression.**

a) $5a^2 + 25ab – 10a$

b) $2p(q – 7) + 2r(7 – q)$

c) $128x■ – 8$

d) $x^2 – 2x – 24$

e) $9x^2 + 27x + 20$

f) $6x^2 + 2x – 28$

g) $8ac – 10ad + 12bc – 15bd$

h) $12xy + 4x^2 – 4 + 9y^2$

Q-26 **Find the value of k that will make each expression a perfect square.**

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

b) $x^2 – 6x + k$

c) $x^2 + 3x + k$

Q-27 **Without using a calculator, simplify $901^2 – 899^2$.**

Q-28 **Solve for x, correct to two decimal places, where necessary.**

a) $x^2 – x + 72 = 0$

b) $6x^2 – x – 4 = 0$

c) $4x^2 + 27x – 7 = 0$

d) $x(x + 1) = 10$

Q-29 **Solve for x by completing the square, correct to two decimal places, where necessary.**

a) $x^2 + 4x – 12 = 0$

b) $x^2 = 8(x – 1)$

c) $2x^2 + 12x – 16 = 0$

d) $-3x^2 + 6x + 1 = 0$

Q-30 **One root of $kx^2 + x - 2k + 2 = 0$ is 1.**

a) Find the value of k.

b) Find the value of the other root.

Q-31 **Use either elimination or substitution to solve for x and y in each pair of linear equations.**

a) $3x + 2y + 11 = 0$ and $4x - 2y = 18$

b) $y + 4x = 1$ and $3x + y = 7/4$

Q-32 **Solve for x and y in each pair of exponential equations.**

a) $2^{(x+y)} = 1$ and $9^{(y-x)} = 3^{12}$

b) $64^{(x-1)} = 4^{(x+y)}$ and $3^{(x-y)} = 1/3$

c) $25^{(x+y)} = 125^{(4y-x)}$ and $2^{(4x+y)} = 8^{(x+2y-1)}$

Q-33 **Solve for x and y in each pair of quadratic equations.**

a) $y = -2x - 6$ and $y = 3x^2 - 7x - 6$

b) $x + y = 7$ and $y = -x^2 + 4x + 3$

Q-34 **The diagrams shows ∆PQR and ∆XYZ, with PQ = 7.8 units, QR = 10.4 units, PR = 6.5 units, XY = 4.2 units, YZ = 5.6 units and XZ = 3.5 units. The triangles have not been drawn to scale. Show, by calculation whether ∆PQR ■ ∆XYZ.**

Q-35 **Find the value of x in each triangle. Leave your answers in surd form, where necessary.**

a)

b)

c)

d)

Q-36 **Use your calculator or trigonometric tables to calculate the following, correct to two decimal places where necessary.**

a) sin 30°

b) sin 45°

c) cos 60°

d) sin 120°

e) cos 135°

f) cos 150°

Q-37 **Calculate the gradient of the line that joins the points.**

a) (1; 5) and (7; 4)

b) (–6; 3) and (–2; –2)

c) (–5; 7) and (–5; 3)

d) (0; –9) and (4; –5)

Q-38 **Find the equation of each line.**

a) The line has a gradient of 1 and it passes through (0; 7).

b) The line has a gradient of –1/2 and it passes through (4; 0).

c) The y■intercept of the line is 8 and the line passes through (1; –2).

d) The y■intercept of the line is 0 and the line passes through (–1; –6).

e) The line passes through (2; 5) and (–10; –1).

f) The line passes through (–4; –2) and (7; 4).

g) The line is parallel to the line 2y + x = 7 and it passes through (–1; 1).

h) The line is perpendicular to the line 5y = 4x and it passes through (0; –12).

Q-39 **Find the equations of the lines A to E in the diagram.**

Chapter-2 Topic 2: Indices and logarithms

Q-1 **Simplify and write each answer with positive indices, where necessary.**

a) $4■ \times 4^2$

b) $3■ \div 3■$

c) $(3^2)^3$

d) $(2■)■^2$

e) $81^{3/■}$

f) $3^{2/3} \times 3^{1/■}$

Q-2 **Simplify and write the answers with positive indices, where necessary.**

a) $(64/27)■^{2/3}$

b) $3■ - 3■^2$

c) $(4■^2 \times 2■)/(2■^3 \times 4^3)$

d) $(9/4)^{1/2} \times (27/125)■^{1/3}$

e) $3■^3 \times 81^{3/2}$

f) $5■^3 \div 5■^2$

Q-3 **Simplify.**

a) 3a/9a■

b) 96a■³/24a■■

c) (144a■■)½

d) (2^(x–1)/5^(x+2)) ÷ (15^(–x–1)/6^(–x+1))

e) (3^(x+1) × 2^(x–1))/(2■¹ × 6^x)

f) (6³ × 4^x)/(12^x × 2³ × 3^(3–x))

Q-4 **Solve each equation.**

a) x^½ = 5

b) x^■ = –4

c) x■² = 36

d) x⅗■ = 3⅗²

e) 25x⅔³ = 1

f) 3x⅗■ – 81 = 0

Q-5 **Solve the equations.**

a) 5■ = 0.04

b) 4■■¹ × 8■■¹ = 16

c) 49■■¹ = 1/7

d) 8■■¹ = 4■

e) 4¾¹■ × 2⅗² = 8■⁄²

f) 9²■■■ = 3³■■¹

Q-6 **Solve.**

a) 3■■¹ – 3■■¹ = 24

b) ((2■)^ 2■ × √(4■³)) / 2■) = 1

c) 2²■■¹ + 4■■¹ + 4■ + (1/4)■■ = 23/16

d) 4■ – 9×2■ + 8 = 0

e) (½×4■ – 2²■) / 4■ + 1 = 2■³■

f) 4■■¹ + (1/4)■■ – 4■ = 25/16

Q-7 **Write the following in logarithm form.**

a) 3■ = 81

b) 8^■ = 2

c) 10³ = 1 000

d) 25■ = 1

e) 8■ = 32

f) a■ = c

Q-8 **Write the following in index form.**

a) log■ 125 = 3

b) log■ ¼ = –2

c) log 10 000 = 4

d) log■ 1 = 0

e) log■ 100 = x

Q-9 **Simplify.**

a) log■ 81

b) log■ 8

c) log■ 16■¹

d) log■ 0.125

e) (log■ 5)³

Q-10 **Express each statement as the logarithm of a single number.**

a) log 3 + log 5

b) log 8 – log 4

c) log 3² + log 2

d) 2 log 3 + 3 log 2

e) 3 log 2 – log 6

f) 1 + log 5 – log 1

Q-11 **Given that log 4 = 0.6021 and log 7 = 0.8451, find the following.**

a) log 49

b) log 28

c) log 2

Q-12 **Simplify.**

a) (log■ 8)/(log■ 4)

b) (log 1)/(log 6)

c) (log 4 + log 9)/(log 8 + log 27)

d) (log 25 – log 4)/(log 2 – log 5)

e) 2 log 20 – 3 log 2 + log 6 – log 3

f) 5 log■ 2 – 2 log■ 8 – log■ 0.125

Q-13 **Simplify.**

a) log■ 2

b) log■/■ 2

c) log■ 243

d) log■■ 128

Q-14 **Write log■ 15 with base 10.**

Q-15 **Simplify log_c a × log_a b × log_b c.**

Q-16 **Prove.**

a) log■ 2 = (log■ 4)/(log■ 4)

b) log■ b = 1/log_b a

c) log■/■ b = –log■ b

Q-17 **Find the value of log■ 8 – log■/■ 32.**

Q-18 **Work out the answers.**

a) 6.245 × 71.8

b) 31.03 × 0.04

c) 7.103 ÷ 2.06

d) 2.987 ÷ 0.035

e) 42.6 × 2.09 ÷ 27.6

f) 532.8 ÷ (1.98 × 22.86)

Q-19 **Work out the answers.**

a) $(3.216)^2$

b) $(0.782)^3$

c) $\sqrt[3]{75.9}$

d) $\sqrt{39.19} - \sqrt[3]{42.6}$

e) $\sqrt[3]{(6^{133} \div 27.4^2)}$

f) $\sqrt{(3.45 \times 6.01)}$

Q-20 **Work out the answers.**

a) $\sqrt[3]{((0.6 \times 9.3)^2)}$

b) $1 \div 0.047^2$

c) $■\sqrt{(22.8^2 \div (4.09 \times 3.44))}$

d) $0.5036■^2$

e) $\sqrt{((1.05 \div 0.082) \div (0.3 \times 0.542))}$

f) $(61.23 \times \sqrt[3]{54.6}) \div 7.91^2$

Q-21 **Solve for x, correct to two decimal places, where necessary.**

a) $\log\blacksquare\ 4 = 1/\blacksquare$

b) $\log\blacksquare\ 1 = 3x$

c) $-\log x = 2$

d) $-2 \log 10 = x$

Q-22 **Solve the equations.**

a) $2\blacksquare = 3\blacksquare$

b) $4^{2\blacksquare\blacksquare^1} = 7^{2\blacksquare\blacksquare^1}$

c) $10\blacksquare\blacksquare^1 = 5^{2\blacksquare\blacksquare^3}$

d) $3\blacksquare\blacksquare^3 = 95$

Q-23 **Solve.**

a) $2 \log x + 3 \log x = 10$

b) $\log\blacksquare\ (x - 3) - 1 = \log\blacksquare\ 5$

c) $\log (x + 2)^2 = 2$

d) $\log\blacksquare\ (x + 1) + \log\blacksquare\ (x - 1) = 3$

Q-24 **Solve.**

a) $\log (x - 8) - 1 = \log (x + 2)$

b) $\log 5 - \log x = \log (5 - x)$

c) $\log (x/2) - \frac{1}{2} \log x = 0$

d) $\log\blacksquare\ x + 2 \log\blacksquare\ 3 = 3$

Chapter-3 Topic 3: Surds

Q-1 **From the list of numbers, choose the following.**

a) all the rational numbers

b) all the irrational numbers

Q-2 **Which statements are true and which are false?**

a) $3/4 \in \blacksquare$

b) $\sqrt[3]{27} \in \blacksquare$

c) $\sqrt{(144/49)} \in \blacksquare$

d) $\sqrt{36} \in \blacksquare'$

e) $\sqrt{400} \in \blacksquare$

f) $\pi \in \blacksquare'$

Q-3 **Between which two integers does each surd lie?**

a) $\sqrt{8}$

b) $\sqrt{17}$

c) $-\sqrt{3}$

d) $-\sqrt{55}$

e) $\sqrt[3]{85}$

f) $\sqrt[3]{-38}$

Q-4 **Which surd is bigger?**

a) $\sqrt{2}$ or $\sqrt[3]{3}$

b) $\sqrt{3}$ or $\sqrt[3]{5}$

c) $\blacksquare\sqrt{3}$ or $\sqrt[3]{4}$

d) $\blacksquare\sqrt{2}$ or $\sqrt[3]{5}$

Q-5 **Arrange each set of numbers in ascending order.**

a) $\sqrt{3}$, 2.5, $\sqrt[3]{8}$

b) $\sqrt{12}$, 3, π

c) $\sqrt{33}$, 5.8, $5\frac{3}{4}$

d) $-\sqrt{5}$, 0, –2.2

Q-6 **Simplify.**

a) $\sqrt{15}$

b) $\sqrt{77}$

c) $-\sqrt{72}$

d) $\sqrt[3]{54}$

e) $\sqrt[3]{-24}$

f) $\blacksquare\sqrt{64}$

Q-7 **Write each number as the square root of a single number.**

a) $3\sqrt{5}$

b) $5\sqrt{6}$

c) $4\sqrt{3}$

d) $2\sqrt{8}$

Q-8 **Simplify the surds.**

a) $\sqrt{44}/2$

b) $\sqrt[3]{24}/2$

c) $(3+\sqrt{18})/3$

d) $(\sqrt{50}+10)/\sqrt{25}$

Q-9 **Simplify.**

a) $\sqrt{5} \times \sqrt{3}$

b) $4\sqrt{2} \times 3\sqrt{6}$

c) $\sqrt{15} \div \sqrt{5}$

d) $9\sqrt{6} \div 3\sqrt{2}$

e) $7\sqrt{7} \times \sqrt{5}$

f) $12\sqrt{21} \div 4\sqrt{7}$

Q-10 **Simplify.**

a) $2\sqrt{5} \times 4\sqrt{5}$

b) $\sqrt{3} \times 3\sqrt{27}$

c) $12\sqrt{32} \div 6\sqrt{2}$

d) $18\sqrt{50} \div 3\sqrt{2}$

Q-11 **Simplify.**

a) $\sqrt{48}/\sqrt{3}$

b) $\sqrt{180}/\sqrt{20}$

c) $4\sqrt{75}/5\sqrt{3}$

d) $9\sqrt{98}/3\sqrt{2}$

Q-12 **Simplify without using a calculator.**

a) $5\sqrt{3} + 5\sqrt{3}$

b) $8\sqrt{2} – 4\sqrt{2}$

c) $–\sqrt{5} + 6\sqrt{5}$

d) $\sqrt{7} + 3\sqrt{7}$

e) $\sqrt{15} + 5\sqrt{15}$

f) $10\sqrt{13} – 3\sqrt{13}$

Q-13 **Simplify without using a calculator.**

a) $2\sqrt{11} + \sqrt{44}$

b) $\sqrt{8} – 4\sqrt{2}$

c) $\sqrt{75} + \sqrt{50}$

d) $\sqrt{27} – \sqrt{9}$

e) $\sqrt[3]{16} + \sqrt[3]{2}$

Q-14 **Simplify without using a calculator.**

a) $\sqrt{18} + \sqrt{8} - \sqrt{50}$

b) $\sqrt{80} - \sqrt{20} - \sqrt{45}$

c) $\sqrt{108} - \sqrt[3]{24} - \sqrt{27}$

d) $\sqrt{242} + \sqrt{200} - \sqrt{288}$

e) $\sqrt[3]{81} - \sqrt[3]{24} - \sqrt[3]{3}$

f) $\sqrt[3]{16} + \sqrt[3]{128} - \sqrt[3]{250}$

Q-15 **Simplify without using a calculator.**

a) $(\sqrt{98} - \sqrt{50})/\sqrt{18}$

b) $(\sqrt{125} - \sqrt{45} - \sqrt{20})/\sqrt{5}$

c) $(\sqrt{128} - \sqrt{50})/(\sqrt{32} + \sqrt{8})$

d) $(\sqrt{99} - \sqrt{11})/\sqrt{44}$

Q-16 **Simplify without using a calculator.**

a) $\sqrt{50}(\sqrt{18} + \sqrt{32})$

Q-17 **Give each conjugate.**

a) $\sqrt{5} - \sqrt{3}$

b) $\sqrt{2} + \sqrt{6}$

c) $\sqrt{7} + 1$

d) $4 - \sqrt{11}$

e) $4\sqrt{5} - \sqrt{5}$

f) $\sqrt{6} + 3\sqrt{2}$

Q-18 **Simplify.**

a) $(\sqrt{7} - 2)(\sqrt{7} + 2)$

b) $(4\sqrt{2} - 3)(4\sqrt{2} + 3)$

c) $(1 - 2\sqrt{5})(1 + 2\sqrt{5})$

d) $(\sqrt{6} - \sqrt{2})(\sqrt{6} + \sqrt{2})$

e) $(3\sqrt{5} - \sqrt{2})(3\sqrt{5} + \sqrt{2})$

f) $(2\sqrt{6} - 3\sqrt{7})(2\sqrt{6} + 3\sqrt{7})$

Q-19 **Rationalise the denominator and simplify.**

a) $5/\sqrt{3}$

b) $-2/\sqrt{5}$

c) $2\sqrt{5}/\sqrt{7}$

d) $11\sqrt{7}/\sqrt{15}$

e) $\sqrt{27}/(2\sqrt{6})$

f) $\sqrt{20}/(2\sqrt{5})$

Q-20 **Rationalise and simplify.**

a) $2/(3+\sqrt{5})$

b) $-1/(\sqrt{7}-1)$

c) $(6-\sqrt{2})/(1+\sqrt{2})$

d) $\sqrt{3}/(2+\sqrt{6})$

e) $(3-\sqrt{2})/(\sqrt{3}-\sqrt{2})$

f) $8\sqrt{2}/(8-\sqrt{8})$

Q-21 **Simplify $(9-2\sqrt{5})/(2-\sqrt{5}) + (9+2\sqrt{5})/(2+\sqrt{5})$.**

Q-22 **Simplify $1/(2-\sqrt{3})^2 - 1/(2+\sqrt{3})^2$.**

Q-23 **Express $-1/(1+\sqrt{2}-\sqrt{3})$ as an equivalent fraction with a rational denominator.**

Chapter-4 Topic 4: Trigonometry

Q-1 **Calculate length NM if NR = 48 units and MR = 50 units.**

Q-2 **Determine the length x in each triangle.**

a)

b)

c)

d)

Q-3 **Calculate the missing length in each right■angled triangle.**

a)

b)

c)

d)

Q-4 **Are the triangles right■angled?**

a)

b)

Q-5 **Calculate length z if the length of diagonal JL is 10 cm.**

Q-6 **Calculate the slant height of each cone. Leave your answer in simplified surd form.**

a) The height (h) is 8 cm and the radius (r) is 5 cm.

b) The height (h) is 15 cm and the radius (r) is 9 cm.

c) The height (h) is 14 and the radius (r) is 6.

Q-7 **Calculate the value of x for each pyramid.**

a) The slant height (s) is 12 cm and the vertical height (h) is 10 cm.

b) The slant height (s) is 24 cm and the vertical height (h) is 18 cm.

c) The slant height (s) is 30 cm and the vertical height (h) is 20 cm.

Q-8 **Calculate length y.**

Q-9 **Use the special triangles and the definitions of the trigonometrical ratios to find each value. Leave 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-10 **Calculate length x in each right-angled triangle.**

Q-11 **Simplify and leave your answers in surd form, where necessary.**

a) cos 60° + sin 30°

b) tan 30° tan 45°

c) (tan 30°)/(cos 30°)

d) cos 30° sin 60° + cos 60° sin 30°

e) $4 \cos^2 60° + \cos 0° - \sin 90°$

f) $\sin^2 30° + \cos^2 30°$

g) $(\tan 60°)/(\tan 30°)$

h) $\sin^2 45° - \sin^2 30°$

i) $(\tan 0° + \cos 90° + \sin 90°)/(\tan 45° \sin 90° \cos 0°)$

j) $(\sin 60° (\sin 30° + \sin 45° \cos 45°))/(\tan 60° + \cos 30°)$

Q-12 **Use the sine and cosine graphs to answer the questions.**

a) Give the coordinates of the maximum value of the graph $y = \sin x$ for $0° \leq x \leq 360°$.

b) Give the coordinates of the minimum value of the graph $y = \cos x$ for $0° \leq x \leq 360°$.

Q-13 **Determine the following.**

a) the amplitude of the graph $y = \sin x$

b) the period of the graph $y = \cos x$

c) the range of the graph $y = \sin x$

Q-14 **Find the value of each ratio.**

a) $\sin 150°$

b) $\cos 180°$

c) $\sin 270°$

d) $\cos 360°$

Q-15 **Find the angle(s) for each ratio.**

a) $\sin \ldots° = 0$

b) $\cos \ldots° = 0.5$

c) $\sin \ldots° = -1$

d) $\cos \ldots° = -0.5$

Q-16 **Solve the equations for $0° \leq \theta \leq 360°$.**

a) $\sin \theta = 0.7$

b) $\cos \theta = 1$

c) $2 \sin \theta = 1$

d) $2 \cos \theta = -1$

Q-17 **One solution is given for each equation. Determine the other possible solution.**

a) $\theta = 75°$ is one solution of $\cos \theta = 0.26$.

b) $\theta = 20°$ is one solution of $\sin \theta = 0.34$.

c) $\theta = 216°$ is one solution of $\sin \theta = -0.59$.

d) $\theta = 134°$ is one solution of $\cos \theta = -0.69$.

Q-18 **Use the graphs and tables to solve the simultaneous equations, correct to one decimal place, where necessary.**

a) $y = \sin x$ and $y = 0.6$

b) $y = \cos x$ and $y = 0.4$

c) $y = \sin x$ and $y = -0.5$

d) $y = \cos x$ and $y = -0.8$

Chapter-5 Topic 5: Matrices and determinants

Q-1 **Need to do it manually**

Need to do it manually

Chapter-6 Topic 6: Simultaneous equations

Q-1 **Solve the simultaneous equations.**

a) $x = y + 2$ and $4x + y = 8$

b) $2x + y = 4$ and $3x - y = 11$

c) $5x + 4y = 0$ and $4x + 5y = -18$

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

e) $5x - 2y = 13$ and $2x - 3y = 3$

f) $y - 2x = 1$ and $2y - 3x = 5$

g) $7x - 5y = 17$ and $3x - 2y = 7$

h) $y = 1/3\ x - 3$ and $y = -2x + 4$

i) $2y = 3x - 13$ and $5x - 6y = 23$

j) $5x - 6y = 27$ and $3x - 2y = 13$

Q-2 **Determine the coordinates of the point of intersection of the straight lines.**

a) $y = 2x + 5$ and $x + 2y = 4$

b) $y = -2x + 7$ and $3x - 2y = 6$

Q-3 **Solve the simultaneous equations.**

a) $y = x^2 + x - 3$ and $y - x = 1$

b) $y = 2x^2 - x - 3$ and $3y = 6x - 9$

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

d) $y = -x + 4$ and $3y + x^2 = 2x + 8$

e) $y = x^2 - x - 6$ and $y = 2x - 2$

f) $4y = -2x^2 - x + 15$ and $4y = 5x + 15$

g) $x^2 + y^2 = 26$ and $x - y = 6$

h) $y = -x - 3$ and $y + x^2 = -4x - 3$

i) $y = x^2 - 11x - 36$ and $y = -12x + 36$

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

Q-4 **Find the coordinates of the points of intersection of the graphs.**

a) $y = -x + 5$ and $y = -x^2 - x + 6$

b) $y = x - 5$ and $y = 2x^2 - 4x - 3$

c) $y = x$ and $y = x^2 - 5$

d) $y = -2x + 13$ and $x^2 + y^2 = 169$

Q-5 **Solve these:**

a) A mother is thirty years older than her son. Ten years ago she was twice his age. How old is the son now?

b) The base of a triangle is 5 m longer than its height. Find the lengths of the base and the height of the triangle if the triangle's area is 42 m^2.

c) The difference between two numbers is 16 and their product is 132. Find the two numbers.

d) Mrs Oyeniran bought equal numbers of apples and tomatoes and equal numbers of oranges and heads of lettuce. The price of apples is ■500 per kilogram and the price of oranges is ■300 per kilogram. She spent ■4 200 on apples and oranges. The price of tomatoes is ■400 per kilogram and the price of heads of lettuce is ■100 per kilogram. She spent ■2 800 on tomatoes and heads of lettuce. How many kilograms of apples and oranges did she buy?

e) An aeroplane takes 50 minutes longer to fly a distance of 1 000 km directly into a wind than it takes if the wind is directly from behind. If the wind has a constant speed of 100 km/h, determine the normal average speed of the aeroplane when there is no wind.

f) Bolu has ■340 in his pocket. He has twice as many ■10■notes than ■50■notes and three times as many ■5■notes as ■50■notes. If there are twenty■four notes in his pocket, how many of each denomination does he have?

g) Mr Olabiyi made two investments. One investment paid 5% interest and the other investment paid 7% interest. If he invested ■100 000 in total and earned interest of ■5 800 in one year, find the amount of each investment.

h) A butcher buys chickens from a farmer for ■8 100. He keeps two chickens at home and sells the rest of the chickens at a profit of 25% per chicken. If his cash takings are ■9 450, calculate how many chickens he sold.

Chapter-7 Topic 7: Surface area and volume of spheres

Q-1 **Calculate the area of a rectangular prism with a breadth of 3.2 cm, a height of 2.8 cm and a length of 9.5 cm.**

Q-2 **Calculate the area of a triangular prism with a length of 15 cm. The cross■section is an equilateral triangle with sides of 10 cm.**

Q-3 **The area of a square■based pyramid is 85 m². If the sides of the square are 5 cm, determine the slant height of the triangular faces.**

Q-4 **Calculate the surface area of the triangular prism in the diagram**

Q-5 **Determine the side of a cube with total surface area of 15.36 cm².**

Q-6 **Calculate the area of a cylinder with a diameter of 4.2 cm and a height of 11 cm.**

Q-7 **Calculate the area of each cone.**

a) The radius is 8 cm and the slant height is 17 cm.

b) The diameter is 14 cm and the perpendicular height is 24 cm.

Q-8 **Calculate the total surface area of each sphere.**

a) The radius is 8 cm.

b) The radius is 4.6 cm.

c) The diameter is 12 cm.

d) The diameter is 15.2 cm.

Q-9 **Calculate the total surface area of each hemisphere.**

a) The radius is 9 cm.

b) The radius is 8.2 cm.

c) The diameter is 16 cm.

d) The diameter is 18.8 cm.

Q-10 **Determine which cylinder has the larger surface area.**

a)

b)

Q-11 **Calculate the volume of a rectangular prism with a breadth of 5.1 cm, a height of 4.8 cm and a length of 12 cm.**

Q-12 **Calculate the volume of a triangular prism with a length of 16 cm. The cross■section is an equilateral triangle with sides of 10 cm.**

Q-13 **The volume of a square■based pyramid is 85 cm^3. If one side of the square base is 5 cm, calculate the slant height of the triangular sides.**

Q-14 **Calculate the volume of the triangular prism**

Q-15 **Determine the side lengths of a cube with a volume of 216 cm^3.**

Q-16 **An open rectangular box has outer measurements: width of 20 cm, length of 40 cm and depth of 15 cm. If the thickness of the pieces of wood is 2 cm, determine the volume of wood that will be used to make the box.**

Q-17 **Calculate the volume of a cylinder with a diameter of 3.2 cm and a height of 15 cm.**

Q-18 **Calculate the volume of a cone with a radius of 3 cm and a height of 8 cm.**

Q-19 **Determine the volume of a barrel with a radius of 35 cm and a height of 75 cm.**

Q-20 **Calculate the volume of a cone-shaped candle with a radius of 2.5 cm and a height of 8 cm.**

Q-21 **Calculate the volume of each sphere.**

a) The radius is 9 cm.

b) The radius is 2.3 cm.

c) The diameter is 16 cm.

d) The diameter is 20.4 cm.

Q-22 **Calculate the volume of each hemisphere.**

a) The radius is 12 cm.

b) The radius is 6.1 cm.

c) The diameter is 48 cm.

d) The diameter is 16.4 cm.

Q-23 **Determine which cylinder has the greater volume.**

Q-24 **A wax crayon consists of a cylinder with a pyramid top on the base of a circle. The length of the cylinder is 90 mm and the diameter of the base is 1 cm. It equals the height of the pyramid. Calculate the volume and surface area of the crayon.**

Q-25 **Calculate the volume and surface area of each solid.**

a) a stepped prism with dimensions 2 m by 1 m by 5 m (diagram)

b) a cone with diameter 10 cm and slant height 13 cm (diagram)

c) a cylinder of height 89 cm and radius 10 cm (diagram)

d) a cylinder of diameter 20 cm and height 80 cm with a cone of height 29 cm attached (diagram)

Q-26 **Calculate the volume and total surface area of the solid that consists of a cone on top of a hemisphere. The radius is 5 cm and the perpendicular height of the cone is 12 cm.**

Q-27 **A ball with radius 8 cm is placed inside a cylinder. Calculate each volume.**

a) The cylinder

b) The ball

c) The space not taken up by the ball

Q-28 **In the cone, R = 12.6 cm, r = 9.2 cm and h = 12 cm. Calculate the following.**

a) The curved surface area of the frustum

b) The volume of the frustum

Q-29 **Calculate the volume of the frustum of a rectangular-based pyramid if the dimensions of the base are 6 m by 4.5 m and the dimensions of the top are 2 m by 1.5 m. The vertical height of the frustum is 10 m.**

Q-30 **Calculate the total surface area and the volume of the cone's frustum.**

Q-31 **Calculate the volume of the frustum of the square-based pyramid.**

Chapter-8 Topic 8: Longitude and latitude

Q-1 **The diagram shows a skeletal globe. Which letter(s) on the skeletal globe correspond with the following?**

a) the North Pole

b) the South Pole

c) the equator

d) lines of latitude

e) lines of longitude

f) great circle

g) small circle

Q-2 **Work in small groups and identify the following on a globe.**

a) the North Pole

b) the South Pole

c) the equator

d) lines of latitude

e) lines of longitude

f) great circles

g) small circles

Q-3 **The lines of longitude and latitude are shown on the map of Nigeria. Refer to the map when answering the questions.**

a) In which hemisphere does Nigeria lie? How can you see this on the map? Explain your reasoning.

b) Identify Enugu on the map. Which other city or town shown on the map lies on the same line of longitude as Enugu?

c) Identify Kaura Namoda on the map. Which other city or town shown on the map lies on the same line of latitude as Kaura Namoda?

d) Which Nigerian city or town lies closest to the equator?

e) Which Nigerian city or town lies furthest from the equator?

f) Which two Nigerian cities or towns lie closest to the Greenwich meridian?

g) Which Nigerian city or town lies furthest from the Greenwich meridian?

Q-4 **The table gives the coordinates of a few capital cities of the world. Refer to the table when answering the questions.**

a) List all the capital cities that lie in the northern hemisphere.

b) List all the capital cities that lie in the southern hemisphere.

c) List all the capital cities that lie to the east of the Greenwich meridian.

d) List all the capital cities that lie to the west of the Greenwich meridian.

Q-5 **Calculate the circumference of a circle with the given radius or diameter.**

a) The radius is 25 cm.

b) The diameter is 6 km.

Q-6 **Calculate the radius of a circle with each circumference.**

a) The circumference is 168 m.

b) The circumference is 43 cm.

Q-7 **Calculate the length of arc AB that subtends an angle of 55° at the centre of a circle with a radius of 12 cm.**

Q-8 **Arc CD has a length of 85 mm and it subtends an angle of 120° at the centre of a circle. Calculate the length of the radius of the circle.**

Q-9 **The circumference of a circle is 98 mm. Arc EF on the circle has a length of 31 mm.**

a) Prove that arc EF is a minor arc.

b) Calculate the angle that EF subtends at the centre of the circle.

c) Hence, calculate the angle that major arc EF subtends at the centre of the circle.

Q-10 **A sphere has a radius of 20 cm. A circle on the surface of the sphere has a circumference of 106.84 cm. Prove, by calculation, whether the circle is a great circle of the sphere or not.**

Q-11 **Calculate the radius of each parallel of latitude. Round off your answers to the nearest kilometre.**

a) 15° N

b) 60° S

c) 85° N

d) 43° S

e) 28° N

f) 75° S

Q-12 **Which two parallels of latitude have a radius of half that of the earth? Explain your reasoning and show all your calculations.**

Q-13 **Given the coordinates of A and B, calculate the distance between these two points, correct to the nearest kilometre.**

a) A (82° N, 10° W) and B (35° N, 10° W)

b) A (6° S, 81° E) and B (62° S, 81° E)

c) A (73° N, 61° E) and B (47° S, 61° E)

d) A (22° S, 76° W) and B (64° N, 76° W)

e) A (39° S, 138° E) and B (49° S, 138° E)

f) A (14° N, 172° W) and B (55° S, 172° W)

Q-14 **Given the coordinates of two cities, calculate the distance between these cities, correct to the nearest kilometre.**

a) Windhoek, Namibia (22.5° S, 17° E) and Bratislava, Slovakia (48° N, 17° E)

b) Sarajevo, Bosnia (44° N, 18.5° E) and Cape Town, South Africa (34° S, 18.5° E)

c) Bucharest, Romania (44.5° N, 26° E) and Bloemfontein, South Africa (29° S, 26° E)

d) Lagos, Nigeria (6.5° N, 3.5° E) and Ghent, Belgium (51° N, 3.5° E)

e) Marseille, France (43.5° N, 5.5° E) and Benin City, Nigeria (6.5° N, 5.5° E)

f) Port Harcourt, Nigeria (5° N, 7° E) and Cannes, France (43.5° N, 7° E)

Q-15 **Point P on the surface of the earth has coordinates (10° S, 115° E). Calculate the coordinates of the point on the earth's surface that is furthest from point P. Explain your reasoning and show all your calculations.**

Q-16 **Given the coordinates of A and B, calculate the distance between these two points, correct to the nearest kilometre.**

a) A (78° S, 113° E) and B (78° S, 76° E)

b) A (54° N, 57° W) and B (54° N, 103° W)

c) A (37° N, 73° E) and B (37° N, 42° W)

d) A (80° S, 149° E) and B (80° S, 36° W)

e) A (29° N, 47° W) and B (29° N, 129° E)

f) A (15° S, 168° E) and B (15° S, 168° W)

Q-17 **Given the coordinates of two cities, calculate the distance between these cities, correct to the nearest kilometre.**

a) Glasgow, Scotland (56° N, 4.5° W) and Moscow, Russia (56° N, 37.5° E)

b) Berlin, Germany (52.5° N, 13.5° E) and Birmingham, England (52.5° N, 2° W)

c) Benin City, Nigeria (6.5° N, 5.5° E) and Monrovia, Liberia (6.5° N, 11° W)

d) Port Louis, Mauritius (20° S, 57.5° E) and Bulawayo, Zimbabwe (20° S, 28.5° E)

e) Sydney, Australia (34° S, 151° E) and Cape Town, South Africa (34° S, 18.5° E)

Q-18 **Abuja, Nigeria (9° N, 7.5° E), Addis Ababa, Ethiopia (9° N, 38.5° E) and Panama City (9° N, 79.5° W) lie on the same line of latitude.**

a) Calculate the distance between the two cities that are closest to each other.

b) Calculate the distance between the two cities that are furthest from each other.

Q-19 **Calculate the difference in time between each pair of cities, correct to the nearest 30 minutes.**

a) Abuja and Washington DC

b) Mexico City and Paris

c) Reykjavik and Cairo

d) Nairobi and New Delhi

e) Beijing and Porto Novo

f) Pretoria and Wellington

g) Lima and Luanda

Q-20 **If it is noon (12:00) in Greenwich (51.5° N, 0° E), calculate the time in each city, correct to the nearest 30 minutes.**

a) Abuja

b) Wellington

c) Nairobi

d) Mexico City

e) Beijing

f) Washington DC

Chapter-9 Topic 9: Finance

Q-1 **Calculate the simple interest that is earned on each amount.**

a) ■120 000 at 6% p.a. for 5 years

b) ■96 000 at 8% p.a. for 4 years

c) ■49 000 at 7.5% p.a. for 6 years

d) ■310 000 at 11% p.a. for 3 years

Q-2 **Calculate the final amount if simple interest is paid annually on each amount.**

a) ■85 000 at 9% p.a. for 2 years

b) ■720 000 at 12% p.a. for 3 years

c) ■64 000 at 8% p.a. for 10 years

d) ■550 000 at 5% p.a. for 8 years

Q-3 **Calculate the number of years for each investment at the simple interest rate.**

a) ■60 000 to grow to ■92 400 at 9% p.a.

b) ■76 000 to grow to ■93 100 at 7.5% p.a.

c) ■109 000 to grow to ■170 040 at 8% p.a.

d) ■350 000 to grow to ■560 000 at 12% p.a.

Q-4 **Calculate the number of years for each simple interest rate depreciation.**

a) ■150 000 to decrease to ■42 000 at 12% p.a.

b) ■78 000 to decrease to ■42 900 at 9% p.a.

c) ■214 900 to decrease to ■103 152 at 6.5% p.a.

d) ■600 000 to decrease to ■240 000 at 8% p.a.

Q-5 **Given each final amount, calculate the amount that was invested.**

a) ■180 000 at 5% p.a. simple interest for 4 years

b) ■99 760 at 12% p.a. simple interest for 6 years

c) ■425 000 at 7% p.a. simple interest for 10 years

d) ■1 250 500 at 10.5% p.a. simple interest for 5 years

Q-6 **Determine each annual simple interest rate.**

a) ■110 000 grows to ■149 600 after 4 years

b) ■28 000 grows to ■54 880 after 8 years

c) ■950 000 decreases to ■707 750 after 3 years

d) ■2 450 000 decreases to ■1 568 000 after 4.5 years

Q-7 **Uche bought a TV set for ■85 000 on a hire purchase agreement. He paid 10% deposit and paid the rest in monthly instalments over two years. Calculate his monthly instalment at an interest rate of 18%.**

Q-8 **A motorbike costs ■450 000. Its value depreciated by 20% per year for the first three years. Calculate the value of the motorbike after three years.**

Q-9 **Machinery that cost ■2 650 000 depreciated to ■1 457 500 in three years on a straight-line reducing balance. Calculate the annual rate of depreciation.**

Q-10 **Determine the interest rate required for an investment of ■850 000 to double in eight years if the amount was invested at simple interest of r% p.a**

Q-11 **Calculate the final amount if compound interest is paid annually on each amount. Round off answers to the nearest whole number.**

a) ■100 000 invested at 9% p.a. for 2 years

b) ■84 000 invested at 5% p.a. for 6 years

c) ■250 000 invested at 6% p.a. for 4 years

d) ■420 000 invested at 12% p.a. for 3 years

Q-12 **Calculate the compound interest that is earned on each amount.**

a) ■60 000 invested at 12% p.a. for 4 years

b) ■525 000 invested at 5% p.a. for 2.5 years

c) ■106 000 invested at 7.5% p.a. for 3 years

d) ■1 250 000 invested at 8% p.a. for 5 years

Q-13 **Calculate the number of years for which each amount is invested at compound interest.**

a) ■75 000 grows to ■146 154 at 10% p.a.

b) ■48 000 grows to ■73 854 at 9% p.a.

c) ■336 000 grows to ■424 192 at 6% p.a.

d) ■2 405 000 grows to ■3 222 930 at 5% p.a.

Q-14 **Given each final amount, calculate the amount that was invested.**

a) ■17 625 at 5% p.a. compound interest after 4 years

b) ■129 255 at 12% p.a. compound interest after 3 years

c) ■392 000 at 7% p.a. compound interest after 6 years

d) ■1 020 000 at 10% p.a. compound interest after 5 years

Q-15 **How long will it take prices to double if the annual inflation rate is 19%?**

Q-16 **■1 500 000 is invested in a savings account for six years. Determine which option would be better.**

Option A: 14% simple interest

Option B: 11% compound interest

Q-17 **A new car cost ■3 800 000. If inflation remains at 5% p.a., calculate the cost of a new car in two years' time.**

Q-18 **How long will it take an investment to lose half of its value if it depreciates on a reducing balance at an interest rate of 10.9% p.a?**

Q-19 **The cost of a barrel of crude oil was \$57 in April 2015 and \$65 in May 2015.**

a) Calculate the percentage increase in the price for a barrel of crude oil.

b) If the price per barrel of crude oil continued to rise at the same rate every month, calculate the price in August. Give your answer to the nearest whole number.

Q-20 **A businessman bought machinery for his factory. Five years later, it had a value of ■1 160 000. Calculate the original price of the machinery if the annual rate of depreciation was 20% on the reducing balance.**

Q-21 **Calculate the future value of an annuity if the following annual payments are made.**

a) ■12 000 for 3 years at 6% p.a. compound interest

b) ■63 000 for 5 years at 8% p.a. compound interest

c) ■110 000 for 6 years at 9% p.a. compound interest

d) ■346 000 for 4 years at 5% p.a. compound interest

Q-22 **Calculate the annual payments that need to be made to receive each annuity.**

a) An annuity of ■500 000 at an interest rate of 6% p.a. compound interest for 2 years

b) An annuity of ■1 607 450 at an interest rate of 7% p.a. compound interest for 3 years

c) An annuity of ■2 502 002 at an interest rate of 12% p.a. compound interest for 4 years

d) An annuity of ■3 890 062 at an interest rate of 9% p.a. compound interest for 5 years

Q-23 **Isikwe was the sole beneficiary of a ■1 507 216 life insurance policy. He received annual payments for 12 years. If the insurance company used 8% p.a. compound interest, how much did he receive every year? Use the formula Pv = x[1 – (1 + i)^–n]/i.**

Q-24 **A company truck cost ■4 250 000. The truck depreciates at 25% on a reducing balance. In five years' time, the company will need to buy a new truck. The cost of the truck is expected to grow at 7.5% p.a. compounded annually. Round off the answers to the nearest whole number.**

a) The value of the old truck in five years' time

b) The cost of a new truck in five years' time

c) The amount of money needed to buy the new truck if the company sells the old truck

d) The annual payments that need to be made into an investment fund that offers 9% p.a. compound interest so that the company will have enough money to buy the new truck in five years' time. Use the formula Fv = x[(1 + i)^n – 1]/i.

Q-25 **Mrs Ozobia took out a loan. She has to repay the loan in annual instalments of ■12 020 for ten years with interest charged on a reducing balance at 12.5% p.a.**

a) Calculate the present value of the loan (to the nearest ■100) using the formula Pv = x[1 – (1 + i)^–n]/i.

b) Calculate the outstanding balance of the loan after five years.

Q-26 **A family bought a house for ■20 006 550. They paid a deposit of 15% and took out a loan from the bank for 25 years at an interest rate of 13% p.a. compounded annually.**

a) Calculate the deposit.

b) Determine the annual repayment on the mortgage bond (the loan).

c) Calculate the total amount they would pay for the house.

Q-27 **Isikwe bought a car that cost ■2 800 000. Interest was charged on the purchase at 18% p.a. compounded annually on a three■year loan. After two years, he paid off the loan.**

a) Calculate the annual repayments.

b) Calculate the amortised value of the loan at the end of two years.

Q-28 **Mr Olisa bought a three■year debenture from a company for ■25 000 000. How much interest did he earn in the three years if the simple interest rate was 13% p.a.?**

Q-29 **Use the income tax table in this topic to calculate the income tax payable on each taxable income.**

a) ■95 000

b) ■480 000

c) ■2 460 000

d) ■3 500 000

Q-30 **Calculate the CGT payable on each sale.**

a) A property that was purchased for ■20 500 000 was sold for ■32 100 000.

b) Machinery that was bought for ■6 000 000 was sold for ■9 500 000.

c) Land that was bought for ■14 200 000 was sold for ■16 350 000.

d) A building that was purchased for ■12 400 000 was sold for ■15 110 000.

Q-31 **Calculate the VAT payable at 5% on each item.**

a) Running shoes: ■12 000

b) A cell phone: ■45 000

c) Jeans: ■9 000

d) Fridge: ■68 561.95

Q-32 **The prices of items includes VAT of 5%. Determine the price before VAT was added.**

a) Machinery: ■2 835 000

b) Car: ■3 097 500

c) Jewellery: ■53 077.50

d) TV set: ■82 740

Q-33 **An item in a shop is marked as ■190 995 VAT-inclusive. How much VAT will the government receive at a VAT-rate of 5% when the item is sold?**

Q-34 **A businessman is paid a salary of ■1 900 000. His salary is increased by 12% at the end of the year.**

a) Determine his new salary.

b) Calculate the actual value of his salary increase by finding the difference between the tax he paid after and before his salary increase.

Q-35 **Mr Mordi wants to be sure that he will be able to pay for a university education for his daughter in five years' time. The annual fees are ■480 000 and they increase every year with inflation at 5%.**

a) Calculate the fees Mr Mordi can expect to pay in five years' time.

b) How much must Mr Mordi pay into an investment scheme every year so that he will have enough money to pay for the fees in five years' time? The investment company offers him 7% p.a. compound interest.

Chapter-10 Topic 10: Coordinate geometry

Q-1 **P, Q and R are points on the Cartesian plane, as shown in the diagram below**

a) Write down the coordinates of points P, Q and R.

b) What can you say about the abscissas of points P and Q?

c) What can you say about the ordinates of points Q and R?

d) What kind of triangle is ■PQR?

e) Determine the coordinates of point S, if PQRS is a rectangle.

Q-2 **Into which quadrant (or on which axis) does each point fall?**

a) (5; 9)

b) (–6; 3)

c) (0; –7)

d) (–1.5; –4)

e) (–4; 3)

f) (16; 0)

g) (21.5; 0.25)

h) (6; –8)

i) (–12; –2)

j) (–9; 1)

Q-3 **Calculate the distance between points P(3; –2) and Q(7; 3) in each case.**

a) (x■; y■) = (3; –2) and (x■; y■) = (7; 3)

b) (x■; y■) = (7; 3) and (x■; y■) = (3; –2)

Q-4 **Find the length of each line on the Cartesian plane. Leave your answers in surd form, where necessary.**

a) MN if M(10; 4) and N(12; 6)

b) PQ if P(–5; 11) and Q(5; 3)

c) ST if S(4; 9) and T(–1; 4)

Q-5 **Calculate the value of k.**

a) P has coordinates (k; –8), Q has coordinates (–10; –8) and the length of PQ is 16 units.

b) A has coordinates (9; 1), B has coordinates (–1; k) and the length of AB is $\sqrt{101}$ units.

c) E has coordinates (k; 5), F has coordinates (2k; 8) and the length of EF is $\sqrt{13}$ units.

Q-6 **Find the coordinates of the midpoint of each pair of points.**

a) (3; –7) and (1; –1)

b) (0; 9) and (6; 3)

c) (–5; –10) and (2; –7)

d) (–4; 0) and (8; –2)

Q-7 **The coordinates of D and E are (–3; 5) and (7; –1), respectively.**

a) Find the coordinates of M if M is the midpoint of DE.

b) Find the coordinates of F if E is the midpoint of DF.

c) Find the coordinates of C if D is the midpoint of CE.

Q-8 **In the diagram, C is the midpoint of line segment AE with coordinates A(–12; 10) and E(4; –14). B is the midpoint of AC and D is the midpoint of CE. Calculate the coordinates of each point:**

a) C

b) B

c) D

Q-9 **In the diagram, PQRS is a rectangle on the Cartesian plane.**

a) By inspection, find the coordinates of Q.

b) Use the midpoint formula to prove that the diagonals of PQRS bisect one another.

Q-10 **Below is a diagram of a football field with length 105 m and width 68 m.**

a) Calculate the length of one diagonal of the field, correct to the nearest metre.

b) Player P is standing in the centre of the field. What are her coordinates?

c) Player P is exactly halfway between Q(24; 10) and R such that QPR is a straight line: i) What are the coordinates of R? Show your calculations. ii) Calculate the distance between Q and R, correct to the nearest metre.

d) Player S(70; 15) kicks the ball so it lands at T(106; 38). What distance on the ground did the ball travel? Correct to the nearest metre.

Q-11 **A Cartesian plane has been superimposed on the map of Nigeria.**

a) Write down the approximate coordinates of each place: i) Yola ii) Kano iii) Enugu iv) Maiduguri v) Abuja vi) Lagos.

b) If 10 units on each axis represent 220 km, calculate the straight-line distance between the following pairs, correct to the nearest kilometre: i) Kaduna and Abuja ii) Kano and Enugu iii) Lagos and Yola iv) Maiduguri and Kano.

Q-12 **Points A(1; 4), B(–2; –3), C(1; 0), D(4; –3) and E(–4; 3) are shown in the diagram. Find the gradient of the straight line that passes through each set of points.**

a) A and E

b) B and E

c) A and C

d) B and D

e) D and E

f) B and C

Q-13 **Calculate the gradient of the line that passes through these points.**

a) (–8; 3) and (–3; 8)

b) (6; –1) and (5; 4)

c) (9; 0) and (0; 3)

d) (–7; 2) and (–9; 6)

Q-14 **If D(5; 7), E(6; –3), F(–4; –1) and G(–2; 7) are the vertices of quadrilateral DEFG, calculate the gradient of each line segment.**

a) DE

b) EF

c) FG

d) DG

e) DF

f) EG

Q-15 **Determine i) the gradient, ii) the y-intercept and iii) the x-intercept of the straight line given by each equation.**

a) $y = -4x - 6$

b) $y = -x$

c) $y = 0.3x - 7.2$

d) $y = -3/4\ x + 1$

Q-16 **Determine i) the gradient, ii) the y-intercept and iii) the x-intercept of the straight line given by each equation.**

a) $3x - 5y = 30$

b) $y + 2x - 6 = 0$

c) $1.5y - 6x = -7.5$

d) $3y + 9 = 2x$

e) $2(y + 4) = 5x$

f) $7 = 4x - y$

Q-17 **Find the equation of each straight line.**

a) The gradient is –1 and the y■intercept is –2/3.

b) The gradient is –4 and the x■intercept is 2.

c) The gradient is –3/5 and the line passes through the point (5; 5).

d) The line passes through the points (1; –9) and (–1; 3).

e) The x■intercept is 5 and the y■intercept is –10.

f) The gradient is 1 and the line passes through the point (2; –2).

g) The y■intercept is 7 and the line is perpendicular to the line $y = 2x - 14$.

h) The x■intercept is –10 and the y■intercept is 12.

i) The line passes through the points (2; –1) and (6; 5).

j) The x■intercept is 5 and the line is parallel to the line $y = -1/10\ x$.

Q-18 **Find the equation of the lines shown in the diagrams.**

a)

b)

c)

d)

Q-19 **Calculate the size of angle θ (correct to one decimal place) that line PQ makes with the positive x■axis in each case.**

a) mPQ = 1

b) mPQ = –1

c) mPQ = _1/4

d) mPQ = –_1/4

e) mPQ = _4/11

f) mPQ = –_4/11

g) mPQ = 2

h) mPQ = –2

Q-20 **Calculate the size of angle θ in each diagram.**

a)

b)

Q-21 **The equation of line AB is $y = -x + 5$ and the equation of line CD is $y = 2x - 1$. Calculate the size of angle θ, correct to one decimal place.**

Q-22 **The equation of line AB is y = –½ x – 2 and the equation of line CD is y = –4x + 2. Calculate the size of angle θ, correct to one decimal place.**

Q-23 **The equation of line AB is y = –■ x + 3 and the equation of line CD is y = ■ x + 2. Calculate the size of angle θ, correct to one decimal place.**

Q-24 **The equation of line AB is y = 6x – 6 and the equation of line CD is y = x – 3. Calculate the size of angle θ, correct to one decimal place.**

Q-25 **The equation of line AB is y = –■/■ x + 4 and the equation of line CD is y = –½ x + 3. Calculate the size of angle θ, correct to one decimal place.**

Q-26 **The volume of a rectangular prism is given by the formula V = lbh, where l is the length, b is the breadth and h is the perpendicular height of the prism. Consider a prism with a length of 5 units and a breadth of 3 units.**

a) Write a formula to express V in terms of h.

b) Explain why this is a linear relationship.

c) Draw the graph of this equation for values of h from 0 to 10.

d) Use your graph to estimate the height of the prism, correct to one decimal place, if its volume is as follows: i) 10 m^3 ii) 50 cm^3 iii) 130 mm^3.

e) Verify your answers to question d) by doing appropriate calculations. Give your answers correct to one decimal place.

Q-27 **Last year, you learnt that the nth term of an arithmetic progression (AP) can be found using the formula Tn = a + (n – 1)d, where a is the first term of the progression and d is the common difference between consecutive terms. Consider an arithmetic progression of which the first term is 8 and the constant difference is 4.**

a) Write a formula to express Tn in terms of n.

b) Explain why this is a linear relationship.

c) Copy and complete the table below.

d) Draw the graph of the values in your table.

e) Use your graph to estimate the value of the following: i) the 10th term ii) the 13th term iii) the 20th term.

f) Verify your answers to question e) by doing appropriate calculations.

g) Use your graph to estimate which term has each value: i) 20 ii) 60 iii) 80.

h) Make n the subject of the formula in your answer to question 2a).

i) Use your answer to question h) to verify your answers to question g).

Q-28 **The relationship between temperature in degrees Celsius (°C) and degrees Fahrenheit (°F) is given by the formula F = ■/■ C + 32.**

a) Explain why this is a linear relationship.

b) Draw the graph of this equation for values of C from 0 to 100.

c) The freezing point of water is 0 °C. Give this temperature in Fahrenheit.

d) The boiling point of water is 100 °C. Give this temperature in Fahrenheit.

e) Use your graph to estimate the temperature in Celsius (to the nearest degree) that corresponds with each temperature: i) 60 °F ii) 100 °F iii) 200 °F.

f) Make C the subject of the formula F = ■/■ C + 32.

Chapter-11 Topic 11: Differentiation of algebraic functions

Q-1 **Evaluate each limit.**

a) $\lim_{■ \to 2} (x^2-4)/(x-2)$

b) $\lim_{■ \to -2} (x^2-4)/(x+2)$

c) $\lim_{■ \to -9} (81-x^2)/(2x+18)$

d) $\lim_{■ \to 0} (x^3+6x)/x$

e) $\lim_{■ \to 3} (x^2-5x+6)/(2x-6)$

f) $\lim_{■ \to 0} (x^2+5x)/(x^2-7x)$

Q-2 **Use first principles to find the derivative of each function.**

a) $f(x) = 4x$

b) $f(x) = x^2$

c) $f(x) = -6x^2$

d) $f(x) = 2x^2 + 5x$

e) $f(x) = -x^3 + x$

f) $f(x) = 2x^3 - 8$

Q-3 **Find the equation of each tangent to a curve.**

a) The tangent to the curve given by $f(x) = x^2$, where $x = -3$.

b) The tangent to the curve given by $f(x) = -6x^2$, where $x = 1$.

c) The tangent to the curve given by $f(x) = 2x^2 + 5x$, where $x = -4$.

d) The tangent to the curve given by $f(x) = -x^3 + x$, where $x = 0$.

e) The tangent to the curve given by $f(x) = 2x^3 - 8$, where $x = -2$.

Q-4 **Calculate f′(x).**

a) $f(x) = 3x$

b) $f(x) = -4x■$

c) $f(x) = \frac{1}{4} x^2$

d) $f(x) = 6$

e) $f(x) = 1/ x^{\blacksquare 2}$

Q-5 **Calculate dy/dx for each value of y.**

a) $y = \sqrt[3]{x}$

b) $y = \sqrt{x^{\blacksquare}}$

c) $y = -\sqrt{x}$

d) $y = \blacksquare\sqrt{x^3}$

Q-6 **Calculate.**

a) $d/dx (\frac{1}{2} \sin x)$

b) $d/dx (-5 \cos x)$

Q-7 **Calculate dy/dx for each value of y.**

a) $y = x^3 - 9x$

b) $y = -3x^{\blacksquare} + 6x^2 - 8$

c) $y = 8x^{\blacksquare} + x^{\blacksquare} - 2x^{\blacksquare} + 3x^2 + 12x - 17$

d) $y = \sqrt{(x^{\blacksquare})} - \sqrt[3]{(x^2)} + \blacksquare\sqrt{x}$

Q-8 **Calculate.**

a) $d/dx (6 \sin x - \cos x + x^2)$

b) $d/dx (\blacksquare\, x^{\blacksquare} - \frac{2}{\blacksquare}\, x^{\blacksquare} + \frac{\blacksquare}{\blacksquare}\, x^{\blacksquare} - \frac{\blacksquare}{\blacksquare}\, x^3 - \frac{1}{\blacksquare\blacksquare}\, x^2 + \sin x)$

c) $d/dx (\frac{2}{\blacksquare}\sqrt{(x^{\blacksquare})} + \frac{2}{\blacksquare}\sqrt{(x^3)} - \frac{1}{2}\sqrt[3]{(x^{\blacksquare})})$

d) $d/dx (x^{\blacksquare} - 3 \cos x + \sqrt{(x^{\blacksquare})} - 4 \sin x - 2)$

Q-9 **Given $y = (x^2 + x)(3x - 5)$.**

a) Use the product rule to find dy/dx.

b) First expand $(x^2 + x)(3x - 5)$, then use the sum and difference rules to find dy/dx.

Q-10 **Given $y = (\sqrt{x} + 2)(\sqrt{x} - 2)$.**

a) Use the product rule to find dy/dx.

b) First expand $(\sqrt{x} + 2)(\sqrt{x} - 2)$, then use the sum and difference rules to find dy/dx.

Q-11 **Use the product rule to calculate the following.**

a) $d/dx (x - 5)(x + 6)$

b) $d/dx (x + 2)(x^2 - 3)$

c) $d/dx (x^2 + x - 4)(3x + 2)$

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

e) $d/dx\ (\sqrt{x})(x - 1)$

f) $d/dx\ (\sqrt[3]{x})(x^2 + 5x)$

g) $d/dx\ (\cos x - 2)(\sin x + \cos x + 3)$

h) $d/dx\ (\cos x - \sqrt{x})^2$

Q-12 **Given $y = (x^2 - x - 6)/(x - 3)$.**

a) Use the quotient rule to find dy/dx.

b) First simplify $(x^2 - x - 6)/(x - 3)$, then use the sum and difference rules to find dy/dx.

c) Compare your answers to questions 1a) and 1b). What do you notice?

Q-13 **Given $y = (6x^2 - x - 2)/(2x + 1)$.**

a) Use the quotient rule to find dy/dx.

b) First simplify $(6x^2 - x - 2)/(2x + 1)$, then use the sum and difference rules to find dy/dx.

c) Compare your answers to questions 2a) and 2b). What do you notice?

Q-14 **Use the quotient rule to calculate the following.**

a) $d/dx\ (1/(4 - 5x))$

b) $d/dx\ ((2x + 1)/(2 - x))$

c) $d/dx\ ((x\blacksquare - 4)/(x^2 - 4))$

d) $d/dx\ (8/(x^2 + 2x - 3))$

e) $d/dx\ ((7x + 2)/(2 - \sqrt{x}))$

f) $d/dx\ ((5 + \sin x)/(\cos x - 3))$

Q-15 **Use the identity $\tan x = \sin x/\cos x$ to find the derivative of tan x.**

Q-16 **A farmer has 200 m of fencing that he wants to use to fence a rectangular piece of ground. Let the length of the rectangle be x m.**

a) Express the breadth of the rectangle in terms of x.

b) Express the area of the rectangle in terms of x.

c) Calculate the dimensions of the rectangle that will allow the farmer to fence in the maximum possible piece of ground.

Q-17 **A player kicks a football into the air. Its trajectory is described by the equation $h(s) = -1/40\ s^2 + s$, where h is its height above the ground and s is the horizontal distance the ball travelled.**

a) Give the mathematical name for the graph of the trajectory of the ball.

b) Calculate the maximum height of the ball above the ground.

c) When the ball reached the ground again, what horizontal distance had it travelled?

Q-18 **A suspension bridge spans a river. The height of the bridge above the water is given by the equation h(s) = ■/■■■■ s^2 – ■/■■ s + 50, where s is the horizontal distance of any point on the bridge from the river bank.**

a) Calculate the minimum height of the bridge above the water.

b) Calculate the width (w) of the river.

Q-19 **A closed cylindrical water tank with a capacity of 8 000 ■ is to be made from steel.**

a) Express the height (h) of the water tank in terms of the radius (r) of its base.

b) Show that the total surface area of the tank is $A = 2\pi r^2 + 16/r$.

c) Determine the dimensions of the water tank that will require the least amount of steel. Write your answers correct to four decimal places.

d) What do you notice about the relationship between the radius and the height of the tank in your answers to question 4c)? e) Calculate the amount of steel (m^2) required to build the water tank. Round off your answer to the nearest whole square metre.

Q-20 **A financial analyst plotted the value of a certain share on the stock market every day in January. He noticed that the value of the share (■) was as follows: ■ x^3 – ³■/■ x^2 + 250x + 900, where x was the number of the day of the month.**

a) On what date was the value of the share the highest?

b) On what date was the value of the share the lowest?

c) Calculate the following: i) the minimum value of the share ii) the maximum value of the share in January.

Q-21 **A jogger is jogging in a straight line. The distance (s) in metres from his starting point is given by s(t) = 2t, where t is the time in seconds.**

a) How far will the jogger jog in five minutes?

b) How long will the jogger take to cover a distance of 5 km? Write your answer in minutes and seconds.

c) Express the velocity of the jogger in terms of t.

d) Express the acceleration of the jogger in terms of t.

e) What do your answers to questions c) and d) mean? Write a few sentences to explain each one.

Q-22 **A racing car that is travelling in a straight line decelerates to a stop. The distance (s) in metres the car covered t seconds after the driver started applying the brakes is given by $s(t) = \blacksquare t^3 - 8t^2 + 64t$.**

a) Express the velocity of the car (v) in terms of t.

b) Express the acceleration of the car (a) in terms of t.

c) Calculate the initial velocity of the car (the velocity at the instant the driver applied the brakes).

d) Express the initial velocity in km/h.

e) Calculate the average velocity of the car between the second and third seconds.

f) Calculate the instantaneous velocity at i) the second second ii) the third second.

g) Calculate the acceleration after i) two seconds ii) three seconds.

h) Calculate the length of time it will take for the car to come to a complete stop.

i) Calculate the stopping distance.

Q-23 **A particle moves along a straight line. The distance (s) in metres from a fixed point is $s(t) = 4t^2 - 16t + 63$, where t is in seconds.**

a) Calculate the average velocity between the sixth and seventh seconds.

b) Calculate the instantaneous velocity at the sixth second.

c) Calculate the acceleration after two seconds.

Q-24 **An air conditioner is switched on in a room of initial temperature 30 °C. The temperature T in °C after t minutes is $T(t) = -0.005t^3 - 0.2t + 30$.**

a) At what rate will the temperature drop at i) t = 1 min ii) t = 5 min iii) t = 8 min iv) t = 10 min?

b) Give the temperature if the air conditioner is switched off after 10 min.

Chapter-12 Topic 12: Integration of simple algebraic functions

Q-1 **Evaluate each integral.**

a) $\int x^3\,dx$

b) $\int x\blacksquare\,dx$

c) $\int x\,dx$

d) $\int x\blacksquare\,dx$

e) $\int \sqrt{x}\,dx$

f) $\int \sqrt[3]{(x^2)}\,dx$

Q-2 **Now check your answers to question 1 by finding the derivative of each answer. Do your answers show that integration and differentiation are the reverse of each other? If not, check your calculations carefully.**

Q-3 **Evaluate the following integrals.Use differentiation to check your answers**

a) $\int 4x^3\,dx$

b) $\int 2x\blacksquare\,dx$

c) $\int (x + 5x^2)\,dx$

d) $\int (2 - 3x)\,dx$

e) $\int (7x\blacksquare + x\blacksquare - 3x)\,dx$

f) $\int (x\blacksquare - 6x\blacksquare + 14)\,dx$

g) $\int (2\sqrt{x} - 4x\blacksquare)\,dx$

h) $\int (\blacksquare/\blacksquare\, x\blacksquare + \blacksquare/\blacksquare\, x)\,dx$

i) $\int (x\blacksquare/\blacksquare + 0.2x^2 + \sqrt[3]{x})\,dx$

j) $\int 4(3x\blacksquare/4 + 25x\blacksquare + 4x^3/9)\,dx$

Q-4 **Evaluate the following. Use differentiation to check your answers.**

a) $\int \blacksquare\,dx$

b) $\int 2x\blacksquare\,dx$

c) $\int (x - 4)^2\,dx$

d) $\int (\sin x + 2\cos x + 3)\,dx$

e) $\int (2\sin x + x^{3}/\blacksquare)\,dx$

f) $\int (1/x^3 - \cos x)\,dx$

g) $\int (5\sqrt{x} - \blacksquare\sqrt{x\blacksquare} - 15)\,dx$

h) $\int [x^2(1/x^2 - 3/x\blacksquare + 9)]\,dx$

i) $\int (x\blacksquare + {}^{12}/\blacksquare\, x\blacksquare + {}^{2}/\blacksquare\, x\blacksquare)\,dx$

Q-5 **Use integration by substitution to evaluate the following.**

a) $\int (2\sin 2x)\,dx$ (Hint: Let u = 2x.)

b) $\int x^2(x^3 + 1)\,dx$ (Hint: Let u = x^3 + 1.)

c) $\int \sin x \times \cos x\,dx$ (Hint: Let u = sin x.)

d) $\int \cos 5x\,dx$ (Hint: Let u = 5x.)

e) $\int (x^3 + x)\blacksquare(3x^2 + 1)\,dx$ (Hint: Let u = x^3 + x.)

f) $\int \sin\blacksquare\, x \times \cos x\,dx$ (Hint: Let u = sin x.)```

Q-6 **Use integration by partial fractions to evaluate the following.**

a) $\int 4/(x^2 + 4x + 3)\, dx$

b) $\int x/(x^2 - 6x + 8)\, dx$

c) $\int (x + 14)/(x^2 + 7x + 10)\, dx$

d) $\int (3x - 7)/(x^2 - 4x + 3)\, dx$

e) $\int (5x - 8)/(x^2 - 2x - 8)\, dx$

f) $\int (-4x + 12)/(x^2 + 6x - 7)\, dx$

Q-7 **The graph of $f(x)=-2x+6$ is shown on the right.**

a) Use the formula for the area of a triangle to calculate the shaded area in the diagram.

b) Use a definite integral to calculate the shaded area.

Q-8 **See the graph of $f(x)=-x^2+7x-6$.**

a) Estimate the shaded area in the diagram by counting the shaded squares.

b) Use a definite integral to calculate the shaded area.

Q-9 **The graph of $f(x)=-x^3+4x^2-3x$ is shown below.Use definite integrals to calculate the sum of the shaded areas.**

Q-10 **Calculate the areas enclosed between the graph of each function, the x-axis and the given values of x (shaded area on one side only).**

a) $f(x)=2x+1$ ($x=1$ and $x=3$)

b) $f(x)=x^2-x-12$ ($x=-3$ and $x=4$)

c) $f(x)=x^3+8$ ($x=-2$ and $x=0$)

d) $f(x)=6$ ($x=2$ and $x=6$)

Q-11 **Exercise 12.7**

a) Need to do it manually

Q-12 **Below is the graph of $f(x)=\frac{1}{2}x^2-2$.**

a) Estimate the shaded area in the diagram by counting the shaded squares.

b) Use Simpson's rule to calculate the shaded area.

Q-13 **In the diagram, v is the velocity (in metres per second) of an object after t seconds. It is described by the function $v(t) = 0.5t$.**

a) Give the initial velocity of the object.

b) What is the velocity of the object when t equals 6 seconds?

c) What does the shaded area in the diagram represent?

d) Use a definite integral to calculate the shaded area in the diagram and include the correct unit of measurement with your answer.

Q-14 **A football on the ground is kicked into the air. The trajectory (path) of the football is described by f(x), where x is time (seconds) after the ball was kicked, and f(x) is the height (metres) of the football above the ground. It is further known that the gradient of the tangent to the curve of f(x) is 12(1 – x).**

a) Use the above information to determine f(x). (Hint: Remember that the gradient of the tangent to any curve is equal to the derivative of the function that defines the curve.)

b) Calculate the maximum height of the football above the ground.

c) How long will it take for the football to reach the ground again?

Q-15 **An object moves in a straight line. Its acceleration is $6t^2$, where the time t is measured in seconds and its distance from its starting point is measured in metres. When t = 0, the object is stationary (it is not moving).**

a) Express the velocity of the object in terms of t.

b) Express the distance of the object from its starting point in terms of t.

c) How far is the object from its starting point after three seconds?

Q-16 **The first diagram shows the area bounded by the straight line f(x) = x, the x-axis and the line x = 2. If this shaded area is rotated through a complete revolution of 360° about the x-axis, the resulting shape is a cone, as shown in the second diagram. The volume of this cone is given by the formula $V = \int_{\blacksquare}^{\blacksquare^2} \pi\,[f(x)]^2\,dx$.**

a) Use this formula to calculate the volume of the cone.

b) Use the following formula to calculate the volume of the cone and check your answer to question a): $V = \frac{1}{\blacksquare}\,\pi\,r^2\,h$.