Questions

Q1.

(a) Find the value of $\sqrt[3]{8 \times 10^6}$

$\sqrt[3]{8} \times \sqrt[3]{10^6}$

$2 \times (10^6)^{1/3}$

$2 \times 10^{6 \times 1/3}$ → 2×10^2

2×10^2 OR 200

.....

(1)

(b) Find the value of $144^{\frac{1}{2}} \times 64^{-\frac{1}{3}}$

$\sqrt{144} \times \frac{1}{64^{1/3}}$

$12 \times \frac{1}{\sqrt[3]{64}}$ → $12 \times \frac{1}{4}$

3

.....

(2)

(c) Solve $3^{2x} = \frac{1}{81}$

$3^{2x} = \frac{1}{3^4}$

$3^{2x} = 3^{-4}$

$2x = -4$

$x = -2$

$x =$ ..... -2 .....

(2)

(Total for question = 5 marks)

Q2.

(a) Write down the value of $64^{\frac{1}{2}}$

$\sqrt{64}$

8

.....

(1)

(b) Find the value of $\left(\frac{8}{125}\right)^{-\frac{2}{3}}$

$\left(\frac{125}{8}\right)^{2/3}$

$\left(\sqrt[3]{\frac{125}{8}}\right)^2$ → $\left(\frac{\sqrt[3]{125}}{\sqrt[3]{8}}\right)^2$

$\left(\frac{5}{2}\right)^2$

$\frac{25}{4}$

.....

(2)

(Total for question = 3 marks)

Q3.

(a) Simplify fully $(3x^5y^6)^4$

$3^4 (x^5)^4 (y^6)^4$

$81 x^{5\times4} y^{6\times4} = 81 x^{20} y^{24}$

$81 x^{20} y^{24}$

(2)

(b) Expand and simplify $(x + 2)(x - 3)(x + 4)$

$(x+2)(x-3)$

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

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

$x^3 - x^2 - 6x + 4x^2 - 4x - 24$

$x^3 + 3x^2 - 10x - 24$

$x^3 + 3x^2 - 10x - 24$

(3)

(Total for question = 5 marks)

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

$2x^3 - 2x^2 - 4x + 3x^2 - 3x - 6$

Q4.

(a) Expand and simplify $(x - 2)(2x + 3)(x + 1)$

$(x-2)(x+1)$

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

$2x^3 + x^2 - 7x - 6$

$2x^3 + x^2 - 7x - 6$

(3)

$\frac{y^4 \times y^n}{y^2} = y^{-3}$

(b) Find the value of n.

$y^4 \times y^n = y^{-3} \times y^2$

$y^{4+n} = y^{-3+2}$

$4 + n = -3 + 2$

$n = -3 + 2 - 4$

$n = -5$

$n = -5$

(2)

(c) Solve $5x^2 - 4x - 3 = 0$

$a = 5 \quad b = -4 \quad c = -3$

Give your solutions correct to 3 significant figures.

$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $\quad \frac{-(-4) \pm \sqrt{(-4)^2 - 4(5)(-3)}}{2(5)}$

$x = \frac{2 + \sqrt{19}}{5}$ $\quad x = \frac{2 - \sqrt{19}}{5}$

$x \approx 1.27$ $\quad x \approx -0.472$

(3)

(Total for question = 8 marks)

Q5.

(a) Find the value of $\sqrt[4]{27 \times 3 \times 10^8}$

$\sqrt[4]{81 \times 10^8}$

$\sqrt[4]{81} \times \sqrt[4]{10^8}$

$3 \times (10^8)^{1/4}$

$3 \times 10^{8 \times 1/4}$

$3 \times 10^2 = 300$

.....

(2)

(b) Find the value of $\left(\frac{216}{1000}\right)^{\frac{2}{3}}$

$\left(\frac{1000}{216}\right)^{2/3} = \left(\frac{\sqrt[3]{1000}}{\sqrt[3]{216}}\right)^2$

$\left(\frac{10}{6}\right)^2 = \frac{100}{36}$

$\frac{25}{9}$

.....

(2)

(Total for question = 4 marks)

Q6.

(i) Find the value of $\sqrt[5]{3.2 \times 10^{11}}$

$3.2 \times 10 \times \frac{10^{11}}{10^1}$

$\sqrt[5]{32 \times 10^{10}}$

$\sqrt[5]{32} \times \sqrt[5]{10^{10}}$

$2 \times (10^{10})^{1/5}$

$2 \times 10^{10 \times 1/5}$

$2 \times 10^2 = 200$

.....

(ii) Find the value of $10^{3/4}$

Give your answer correct to 1 decimal place.

$(\sqrt[4]{10})^3$

5.6

.....

(Total for question = 2 marks)

Q7.

$2.5 = \frac{25}{10} = \frac{5}{2}$ (÷5, ÷5)

(a) Find the reciprocal of 2.5

$\frac{1}{2.5}$

$0.4 = \frac{2}{5}$

.....

(1)

(b) Work out $\sqrt[3]{\frac{4.3 \times \tan 39°}{23.4 - 6.06}}$

Give your answer correct to 3 significant figures.

0.291

.....

(2)

(Total for question is 3 marks)

Q8.

Write down the value of $125^{\frac{2}{3}}$

$125^{2/3}$

$(\sqrt[3]{125})^2$

$5^2 = 25$

25

.....

(Total for question is 1 mark)

Q9.

(a) Write $\frac{3^5 \times 3^4}{3^2}$ as a power of 3

$3^{5+4-2} = 3^7$

3^7

.....

(2)

(b) Write down the value of 12^0

1

.....

(1)

(c) Write down the value of 3^{-2}

$\frac{1}{3^2} = \frac{1}{9}$

$\frac{1}{9}$

.....

(1)

(Total for question = 4 marks)

Q10.

Work out the value of $\frac{3^7 \times 3^{-2}}{3^3}$

$3^{7+(-2)-3}$

$3^{7-2-3} = 3^2 = 9$

9

.....

(Total for question = 2 marks)

Q11.

Work out the value of $\frac{\left(5\frac{4}{9}\right)^{-\frac{1}{2}} \times \left(4\frac{2}{3}\right)}{2^{-3}}$

You must show all your working.

$\frac{\left(\frac{49}{9}\right)^{-1/2} \times \frac{14}{3}}{2^{-3}}$

16

.....

(Total for question = 4 marks)

$\frac{\left(\frac{9}{49}\right)^{1/2} \times \frac{14}{3}}{\frac{1}{2^3}} \Rightarrow \frac{\frac{\sqrt{9}}{\sqrt{49}} \times \frac{14}{3}}{\frac{1}{8}} \Rightarrow \frac{\frac{3}{7} \times \frac{14}{3}}{\frac{1}{8}} = \frac{2}{\frac{1}{8}}$

Q12. $2 \div \frac{1}{8} = 2 \times \frac{8}{1} = 16$

Simplify $(2^{-5} \times 2^{8})^{2}$

Give your answer as a power of 2

$(2^{-5})^{2} \times (2^{8})^{2}$ | $(2^{-5+8})^{2}$

$2^{-10} \times 2^{16}$ | $(2^{3})^{2}$

$2^{-10+16} = 2^{6}$ | $2^{3\times 2} = 2^{6}$

2^{6}

.....

(Total for question = 2 marks)

Q13.

Work out the value of $\left(\frac{8}{27}\right)^{\frac{4}{3}}$

$\left(\frac{\sqrt[3]{8}}{\sqrt[3]{27}}\right)^{4} = \left(\frac{2}{3}\right)^{4} = \frac{16}{81}$

$\frac{16}{81}$

.....

(Total for question = 2 marks)

Q14.

(a) Write $\frac{1}{16}$ in the form 4^{n} where n is an integer.

$\frac{1}{4^{2}} = 4^{-2}$

4^{-2}

.....

(1)

(b) Work out the value of $8^{\frac{5}{3}} - 9^{\frac{3}{2}}$

$(\sqrt[3]{8})^{5} - (\sqrt{9})^{3}$

$2^{5} - 3^{3}$

$32 - 27$

5

.....

(3)

(Total for question = 4 marks)

Q15.

(a) (i) Write down the value of 5^0

1

.....

(1)

(ii) Write down the value of 5^{-2}

$\frac{1}{5^2} = \frac{1}{25}$

$\frac{1}{25}$

.....

(1)

(b) Write $\frac{2^5 \times 2^4}{2^3}$ in the form 2^n where n is an integer.

$2^{5+4-3} = 2^6$

2^6

.....

(2)

(Total for question = 4 marks)

Q16.

Work out the value of $27^{\frac{2}{3}} + \left(\frac{1}{2}\right)^{-3}$

$\left(\sqrt[3]{27}\right)^2 + \left(\frac{2}{1}\right)^3$

$3^2 + 8$

$9 + 8 = 17$

17

.....

(Total for question = 3 marks)

Q17.

$2^x = \frac{2^n}{\sqrt[3]{2}}$ $2^y = \left(\sqrt{2}\right)^5$

$x + y = 8$

$n - \frac{1}{3} + \frac{5}{2} = 8$

$n = 8 + \frac{1}{3} - \frac{5}{2}$

$n = \frac{8\times6}{1\times6} + \frac{1\times2}{3\times2} - \frac{5\times3}{2\times3}$

$n = \frac{48}{6} + \frac{2}{6} - \frac{15}{6}$

$n = \frac{35}{6}$

Given that $x + y = 8$

work out the value of n.

$2^x = \frac{2^n}{2^{1/3}}$ $2^y = (2^{1/2})^5$

$2^x = 2^{n-1/3}$ $2^y = 2^{1/2\times5}$

$2^y = 2^{5/2}$

$x = n - \frac{1}{3}$ $y = \frac{5}{2}$

$n =$ $\frac{35}{6}$

(Total for question = 3 marks)

Q18.

(a) Work out $25^{\frac{1}{2}} \times 8^{\frac{1}{3}}$

$\sqrt{25} \times \sqrt[3]{8}$

$5 \times 2 = 10$

10

(2)

(b) Find the value of $\left(\frac{1}{32}\right)^{\frac{3}{5}}$

$\left(\sqrt[5]{\frac{1}{32}}\right)^3 = \left(\frac{\sqrt[5]{1}}{\sqrt[5]{32}}\right)^3 = \left(\frac{1}{2}\right)^3 =$ $\frac{1}{8}$

(2)

(Total for question = 4 marks)

Q19.

(a) Simplify fully $2x^3y^5 \times 7x^2y^1$

$14x^{3+2}y^{5+1}$

$14x^5y^6$

(2)

(b) Simplify $(m^2)^{-3}$

$\frac{1}{(m^2)^3} = \frac{1}{m^{2\times3}} = \frac{1}{m^6}$

m^{2x-3}

m^{-6}

$\frac{1}{m^6} = m^{-6}$

.....

(1)

(Total for question = 3 marks)

Q20.

Given that $9^{-\frac{1}{2}} = 27^{\frac{1}{4}} \div 3^{x+1}$

find the exact value of x.

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

$3^{2x-\frac{1}{2}} = \frac{3^{3\times 1/4}}{3^{x+1}}$

$3^{-1} = 3^{3/4 - x - 1}$

$-1 = \frac{3}{4} - x - 1$

$x = \frac{3}{4}$

$x =$ 3/4 .....

(Total for question = 3 marks)

Q21.

(a) Work out the value of $\left(\frac{16}{81}\right)^{\frac{3}{4}}$

$\left(\sqrt[4]{\frac{16}{81}}\right)^3$

$\left(\frac{\sqrt[4]{16}}{\sqrt[4]{81}}\right)^3 = \left(\frac{2}{3}\right)^3 = \frac{2^3}{3^3} = \frac{8}{27}$

8/27 .....

(2)

$3^a = \frac{1}{9}$ $3^b = 9\sqrt{3}$ $3^c = \frac{1}{\sqrt{3}}$

(b) Work out the value of $a + b + c$

$3^a = \frac{1}{3^2}$ $3^b = 3^2 \times 3^{1/2}$ $3^c = \frac{1}{3^{1/2}}$

$3^a = 3^{-2}$ $3^b = 3^{2+1/2}$ $3^c = 3^{-1/2}$

$a = -2$ $3^b = 3^{5/2}$ $c = -1/2$

$b = 5/2$

$a+b+c = -2 + 2{\cdot}5 - 0{\cdot}5 = 0$

0 .....

(2)

(Total for question = 4 marks)

Q22.

(a) Simplify $(x^3)^5$

$x^{3\times5} = x^{15}$

x^{15}

.....

(1)

(b) Expand and simplify $4(x + 3) + 7(4 - 2x)$

$4x + 12 + 28 - 14x$

$4x - 14x + 12 + 28$

$-10x + 40$

$-10x + 40$

.....

(2)

(c) Factorise fully $15x^3 + 3x^2y$

$3x^2[5x + y]$

$3x^2[5x + y]$

.....

(2)

(Total for question = 5 marks)

Q23.

(a) Simplify $(m^2)^3$

$m^{2\times3} = m^6$

m^6

.....

(1)

(b) Simplify $x^5 \times x^8$

$x^{5+8} =$

x^{13}

.....

(1)

(c) Expand $4p(p^2 + 3p)$

$4p \times p^2 = 4p^3$

$4p \times 3p = 12p^2$

$4p^3 + 12p^2$

.....

(2)

(Total for question = 4 marks)

Q24.

Write

$$\frac{(6x^5y^3)^2}{3x^2y^7 \times 4x^1y^{-3}}$$

in the form $ax^b y^c$ where a, b and c are integers.

$3xc^7y^2$

.....

(Total for question = 3 marks)

Q25.

(a) Simplify $n^3 \times n^5$

n^8

.....

(1)

(b) Simplify $\frac{c^3d^4}{c^2d^1}$

cd^3

.....

(2)

(c) Solve $\frac{5x}{2} > 7$

$5x > 14$

$x > \frac{14}{5}$

$x > 2 \cdot 8$

.....

(2)

(Total for question = 5 marks)

Q26.

(a) Express $\sqrt{\frac{10^{360}}{10^{150} \times 10^{90}}}$ as a power of 10

$$\frac{(10^{360})^{1/2}}{(10^{150+90})^{1/2}} = \frac{10^{180}}{(10^{240})^{1/2}} = \frac{10^{180}}{10^{120}} = 10^{180-120} = 10^{60}$$

10^{60}

.....

(3)

Liam was asked to express $(12^{50})^2$ as a power of 12

Liam wrote $(12^{50})^2 = 12^{50^2} = 12^{2500}$

Liam's method is wrong.

(b) Explain why.

$(12^{50})^2 = 12^{50 \times 2} = 12^{100}$

.....

Liam should have multiplied 50 by 2 based on brackets law

.....

not squaring 50.

.....

(1)

(Total for question = 4 marks)

Q27.

$(ax^6)^{\frac{1}{n}} = 7x^3$

Work out the value of a and the value of n.

$a^{\frac{1}{n}} (x^6)^{1/n} = 7x^3$

$a^{\frac{1}{n}} x^{6 \times \frac{1}{n}} = 7x^3$

$a^{\frac{1}{n}} x^{\frac{6}{n}} = 7x^3$

$\frac{6}{n} = 3$ $\quad a^{1/2} = 7$

$n = 2$ $\quad (a^{1/2})^2 = 7^2$, $\quad a = 49$

$a =$ 49

$n =$ 2

(Total for question = 2 marks)

Q28.

$16^{1/5} \times 2^x = 8^{3/4}$

Work out the exact value of x.

$(2^4)^{1/5} \times 2^x = (2^3)^{3/4}$

$2^{4 \times \frac{1}{5}} \times 2^x = 2^{3 \times 3/4}$

$2^{4/5} \times 2^x = 2^{9/4}$

$2^{4/5 + x} = 2^{9/4}$

$\frac{4}{5} + x = \frac{9}{4}$

$x = \frac{9}{4} - \frac{4}{5}$

$x = \frac{9 \times 5}{4 \times 5} - \frac{4 \times 4}{5 \times 4}$

$x = \frac{45}{20} - \frac{16}{20} = \frac{29}{20}$

$x = \frac{29}{20}$

(Total for question = 3 marks)

Q29.

Given that $3^{-n} = 0.2$

find the value of $(3^4)^n$

3^{4n}

$\frac{1}{3^n} = \frac{1}{5}$

$(5)^4 = (3^n)^4$

$3^{4n} = 5^4$

$(3^4)^n = 625$

$5^4 = 625$

.....

(Total for question = 2 marks)

Q30.

(a) Write down the value of 7^0

1

.....

(1)

(b) Find the value of $3^1 \times 3^6 \times 3^{-6}$

$3^{1+6-6} = 3^1$

3

.....

(1)

(c) Find the value of 2^{-4}

$\frac{1}{2^4} = \frac{1}{16}$

$\frac{1}{16}$

.....

(1)

(d) Find the value of $27^{\frac{1}{3}}$

$\sqrt[3]{27}$

3

.....

(1)

(Total for question = 4 marks)

Q31.

(a) Write down the value of $100^{\frac{1}{2}}$

$\sqrt{100}$

10

.....

(1)

(b) Find the value of $125^{\frac{2}{3}}$

$(\sqrt[3]{125})^2$

$(5)^2 = 25$

25

.....

(2)

(Total for question = 3 marks)

Q32.

$p^3 \times p^x = p^9$

(a) Find the value of x.

$p^{3+x} = p^9$

$3+x = 9$, $x = 9-3$

$x = 6$

$x =$ 6 .....

(1)

$(7^2)^y = 7^{10}$

(b) Find the value of y.

$7^{2\times y} = 7^{10}$

$7^{2y} = 7^{10}$

$\frac{2y}{2} = \frac{10}{2}$

$y = 5$

$y =$ 5 .....

(1)

$1000^a \times 1000^b$ can be written in the form 10^w

(c) Show that [redacted]

$w = 3a + 3b$

$(10^3)^a \times (10^3)^b$

$10^{3a} \times 10^{3b}$

10^{3a+3b}

10^w

$w = 3a + 3b$

(2)

(Total for question = 4 marks)

Q33.

Find the value of $64^{-\frac{2}{3}}$

$\frac{1}{64^{2/3}} = \frac{1}{\left(\sqrt[3]{64}\right)^2} = \frac{1}{4^2} = \frac{1}{16}$

$\frac{1}{16}$

.....

(Total for question = 1 mark)

Q34.

(a) Find the value of $81^{-\frac{1}{2}}$

$\frac{1}{81^{1/2}} = \frac{1}{\sqrt{81}} = \frac{1}{9}$

$\frac{1}{9}$

.....

(2)

(b) Find the value of $\left(\frac{64}{125}\right)^{\frac{2}{3}}$

$\left(\sqrt[3]{\frac{64}{125}}\right)^2$

$\frac{16}{25}$

.....

(2)

$\left(\frac{\sqrt[3]{64}}{\sqrt[3]{125}}\right)^2 = \left(\frac{4}{5}\right)^2 = \frac{4^2}{5^2} = \frac{16}{25}$

(Total for question = 4 marks)

Q35.

(a) Write down the value of $36^{\frac{1}{2}}$

$\sqrt{36}$

6

.....

(1)

(b) Write down the value of 23^0

1

.....

(1)

(c) Work out the value of $27^{-\frac{2}{3}}$

$\frac{1}{27^{2/3}} = \frac{1}{(\sqrt[3]{27})^2} = \frac{1}{3^2} = \frac{1}{9}$

$\frac{1}{9}$

.....

(2)

(Total for question = 4 marks)

Mark Scheme

Q1.

Question	Working	Answer	Notes
a		200	B1 200 or 2×10^2
b		3	B1 12 and $\frac{1}{4}$ A1 3 cao
c		−2	M1 $81 = 3^4$ or $\frac{1}{81} = 3^{-4}$ A1 cao

Q2.

Paper 1MA1: 1H			
Question	Working	Answer	Notes
(a)		8	B1
(b)		$\frac{25}{4}$ oe	M1 for correct first step A1