Indices and Standard Form

Question 1

$$\frac{8^{-2} \times 8^{9}}{8^{10}} = 8^{n}$$

Work out the value of n

$\frac{8^{7}}{8^{10}} = 8^{n}$ (1)

$8^{-3} = 8^{n}$

$n =$ -3 (1)

(2)

Question 2

Simplify fully $\frac{36a^{5}c^{7}}{12a^{2}c^{3}}$

$3a^{3}c^{4}$

(1) **(2)** (1)

Question 3

(a) Write 5.76×10^4 as an ordinary number.

57 600 (1)

(b) Work out $\dfrac{3 \times 10^5 + 8 \times 10^3}{4 \times 10^{-2}}$

Give your answer in standard form.

$$\frac{10^3(3 \times 10^2 + 8)}{4 \times 10^{-2}} = \frac{308 \times 10^3}{4 \times 10^{-2}}$$

$$= 77 \times 10^5$$

$$= 7.7 \times 10^6$$

(2)

Question 4

(a) Simplify fully $\left(\dfrac{125x^6}{y^{15}}\right)^{\frac{2}{3}}$

$$= \left(\sqrt[3]{\frac{125x^6}{y^{15}}}\right)^2$$

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

$$\frac{25x^4}{y^{10}}$$

(2)

Given that $4^n = \dfrac{4^m}{64^p}$

(b) Express n in terms of m and p

$$4^n = \frac{4^m}{4^{3p}}$$

$$4^n = 4^{m-3p}$$

$n = m - 3p$ .....(2)

Question 5

Simplify fully $\left(\frac{2a^3}{10a^7c^2}\right)^{-3}$

$= \left(\frac{10a^7c^2}{2a^3}\right)^3$

$= (5a^4c^2)^3$ (1)

$125a^{12}c^6$ (1) (1)

(3)

Question 6

Given that $\frac{3^{2n+3}}{3^4} = 3^3 \times 3^{1-2n}$

find the value of n
Show your working clearly.

$3^{2n+3-4} = 3^{3+1-2n}$ (1)

$2n - 1 = 4 - 2n$ (1)

$4n = 5$

$n = \frac{5}{4}$ (1)

(3)

Question 7

Simplify $\frac{30 \times 25^{2x+7}}{\sqrt{180} \times (\sqrt{5})^{4x+9}}$

Give your answer in the form 5^w where w is an expression in terms of x
Show each stage of your working clearly.

$\frac{6 \times 5 \times (5^2)^{2x+7}}{6 \times 5^{\frac{1}{2}} \times (5^{\frac{1}{2}})^{4x+9}}$ (1)

$= \frac{5^{4x+15}}{5^{2x+5}}$

$= 5^{2x+10}$ (1)

$\frac{5 \times 5^{4x+14}}{5^{\frac{1}{2}} \times 5^{2x+\frac{9}{2}}}$ (1)

(1)

(3)

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Question 8

Simplify fully $\left(2g^3k^5\right)^4$

$16g^{12}k^{20}$

(2)

Given that $\frac{y^5 \times y^n}{y^7} = y^{12}$

work out the value of n

$\frac{y^{n+5}}{y^7} = y^{12}$

$y^{n+5} = y^{19}$ (1)

$n + 5 = 19$

$n =$ 14 (1)

(2)

Question 9

$2^7 \times 4^5 = 4^x$

(a) Calculate the value of x

$2^7 \times (2^2)^5 = (2^2)^x$

$2^7 \times 2^{10} = 2^{2x}$ (1)

$2x = 17$

$x =$ 8.5 (1)

(2)

(b) Simplify fully $\left(125p^6y^{24}\right)^{\frac{2}{3}}$

$= (5p^2y^8)^2$

$= 25p^4y^{16}$ (1) (1)

(2)

Question 10

(a) $\sqrt{2} \div \frac{8^3}{16^{\frac{3}{2}}} = 2^n$

Work out the value of n
Show your working clearly.

$2^{\frac{1}{2}} \times \frac{(2^4)^{3/2}}{(2^3)^3} = 2^n$

$2^{\frac{1}{2}} \times \frac{2^6}{2^9} = 2^n$ (1)

$\frac{2^{6.5}}{2^9} = 2^n$ (1)

$2^{-2.5} = 2^n$

$n =$ -2.5 (1)

(3)

Question 11

(a) Simplify fully $(32a^{15})^{\frac{3}{5}}$

$= (2a^3)^3$

$8a^9$ (1) (1)

(2)

(b) Express $\left(\frac{1}{10x}\right)^{-3}$ in the form px^n where p and n are integers.

$\left(\frac{10x}{1}\right)^3 =$

$1000x^3$ (1) (1)

(2)

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Question 12

$3^{\frac{1}{2}} \times 3^{\frac{2}{5}} = 3^m$

(a) Work out the value of m

$3^{0.9} = 3^m$

$m =$ 0.9 (1)

(1)

$5^{-10} \div 5^{-4} = 5^n$

(b) Work out the value of n

$5^{-6} = 5^n$

$n =$ −6 (1)

(1)

Question 13

Find the values of n such that

$$\frac{10^{4n} \times 2^{3(n^2-5n)} \times 5^{2(1-2n)}}{20^2} = 1$$

Show clear algebraic working.

$$\frac{(2\times5)^{4n} \times 2^{3n^2-15n} \times 5^{2-4n}}{(2^2\times5)^2} = 1 \quad (1)$$

$$\frac{2^{4n} \times 5^{4n} \times 2^{3n^2-15n} \times 5^{2-4n}}{2^4 \times 5^2} = 1 \quad (1)$$

$$\frac{2^{3n^2-11n} \times 5^2}{2^4 \times 5^2} = 1$$

$$2^{3n^2-11n-4} = 2^0 \quad (1)$$

$$3n^2 - 11n - 4 = 0$$

$$\frac{(3n-12)(3n+1)}{3} = 0 \quad (1)$$

$$(n-4)(3n+1) = 0$$

$n = 4,\ n = -\frac{1}{3}$ (1)

.....(5)

Question 14

(a) Simplify $8 \times (4t)^0$

8

(1)

$x^6 \div x^{-5} = x^p$

(b) Find the value of p

$p =$ 11

(1)

(c) Simplify fully $(2k^2m^4)^3$

$8k^6m^{12}$

(2)

Question 15

$$\frac{18 \times \left(\sqrt{27}\right)^{4n+6}}{6 \times 9^{2n+8}} = 3^x$$

Express x in terms of n

Show your working clearly and simplify your expression.

$$\frac{3^2 \times 2 \times (3^3)^{\frac{1}{2}(4n+6)}}{3 \times 2 \times (3^2)^{2n+8}} = 3^x \quad (1)$$

$$\frac{3^2 \times 2 \times 3^{6n+9}}{3 \times 2 \times 3^{4n+16}} = 3^x \quad (1)$$

$$\frac{3^{6n+11}}{3^{4n+17}} = 3^x$$

$$3^{2n-6} = 3^x \Rightarrow \boxed{x = 2n-6} \quad (1)$$

.....(3)

Question 16

Simplify $(64p^9q^{12})^{\frac{2}{3}}$

$= (4p^3q^4)^2$

$= 16p^6q^8$ (1) (1) (2)

Question 17

Given that $\frac{3^x}{9^{3x}} = 81$

find the value of x.
Show clear algebraic working.

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

$\frac{3^x}{3^{6x}} = 3^4$

$3^{-5x} = 3^4$ (1)

$-5x = 4$

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

$x = -\frac{4}{5}$ (1)

..... (3)