

Indices (Solutions)

Q1, (OCR MEI 4751, Jun 2013, Q3)

(i) Evaluate $(0.2)^{-2}$.

[2]

(ii) Simplify $(16a^{12})^{\frac{3}{4}}$.

[3]

i/ $0.2^{-2} = \left(\frac{1}{5}\right)^{-2} = 5^2 = 25$

ii/ $(16a^{12})^{\frac{3}{4}} = 16^{\frac{3}{4}} \times (a^{12})^{\frac{3}{4}} = 2^3 \times a^9 = 8a^9$

Q2, (OCR MEI 4751, Jan 2013, Q1)

Find the value of each of the following.

(i) $\left(\frac{5}{3}\right)^{-2}$

[2]

(ii) $81^{\frac{3}{4}}$

[2]

i/ $\left(\frac{5}{3}\right)^{-2} = \left(\frac{3}{5}\right)^2 = \frac{9}{25}$

ii/ $81^{\frac{3}{4}} = 3^3 = 27$

Q3, (OCR MEI 4751, Jan 2013, Q2)

Simplify $\frac{(4x^5y)^3}{(2xy^2) \times (8x^{10}y^4)}$.

[3]

$$(4x^5y)^3 = 4^3 \times (x^5)^3 \times y^3 = 64x^{15}y^3$$

$$(2xy^2) \times (8x^{10}y^4) = 16x^{11}y^6$$

$$\therefore \frac{64x^{15}y^3}{16x^{11}y^6} = 4x^4y^{-3}$$

Q4 (OCR MEI 4751, Jan 2012, Q2)

(i) Evaluate $9^{-\frac{1}{2}}$.

[2]

(ii) Simplify $\frac{(4x^4)^3 y^2}{2x^2 y^5}$.

[3]

i/ $9^{-\frac{1}{2}} = \left(\frac{1}{9}\right)^{\frac{1}{2}} = \frac{1}{3}$

ii/ $\frac{(4x^4)^3 y^2}{2x^2 y^5} = \frac{64x^{12}y^2}{2x^2 y^5} = 32x^{10}y^{-3}$

Q5, (OCR 4721, Jun 2016, Q5)

Express the following in the form 2^p .

(i) $(2^5 \div 2^7)^3$

[2]

(ii) $5 \times 4^{\frac{2}{3}} + 3 \times 16^{\frac{1}{3}}$

[3]

i/ $(2^5 \div 2^7)^3 = (2^{-2})^3 = 2^{-6}$

ii/ $5 \times 4^{\frac{2}{3}} + 3 \times 16^{\frac{1}{3}} = 5 \times (2^2)^{\frac{2}{3}} + 3 \times (2^4)^{\frac{1}{3}}$
 $= 5 \times 2^{\frac{4}{3}} + 3 \times 2^{\frac{4}{3}}$
 $= 8 \times 2^{\frac{4}{3}} = 2^3 \times 2^{\frac{4}{3}}$
 $= 2^{3 + \frac{4}{3}} = 2^{\frac{9}{3} + \frac{4}{3}} = 2^{\frac{13}{3}}$

Q6 (OCR 4721, Jun 2015, Q3)

Express each of the following in the form 5^k .

(i) 25^4

[1]

(ii) $\frac{1}{\sqrt[4]{5}}$

[2]

(iii) $(5\sqrt{5})^3$

[2]

i/ $25^4 = (5^2)^4 = 5^8$

ii/ $\frac{1}{\sqrt[4]{5}} = \frac{1}{5^{\frac{1}{4}}} = 5^{-\frac{1}{4}}$

iii/ $(5\sqrt{5})^3 = (5^1 \times 5^{\frac{1}{2}})^3 = (5^{\frac{3}{2}})^3 = 5^{\frac{9}{2}}$

Q7 (OCR 4721, Jan 2013, Q2)

Solve the equations

(i) $3^n = 1$,

[1]

(ii) $t^{-3} = 64$,

[2]

(iii) $(8p^6)^{\frac{1}{3}} = 8$.

[3]

i/ $3^0 = 1 \Rightarrow n = 0$

ii/ $t^{-3} = 64 \Rightarrow t^3 = \frac{1}{64} \Rightarrow t = \frac{1}{4}$

iii/ $(8p^6)^{\frac{1}{3}} = 8 \Rightarrow 2p^2 = 8 \Rightarrow p^2 = 4 \Rightarrow p = \pm 2$

Q8 (OCR 4221, Jun 2012, Q2)Express each of the following in the form 7^k :

(i) $\sqrt[4]{7}$,

[1]

(ii) $\frac{1}{7\sqrt{7}}$,

[2]

(iii) $7^4 \times 49^{10}$.

[2]

i/ $\sqrt[4]{7} = 7^{\frac{1}{4}}$

ii/ $\frac{1}{7\sqrt{7}} = \frac{1}{7^1 \times 7^{\frac{1}{2}}} = \frac{1}{7^{\frac{3}{2}}} = 7^{-\frac{3}{2}}$

iii/ $7^4 \times 49^{10} = 7^4 \times (7^2)^{10} = 7^4 \times 7^{20} = 7^{24}$

Q9, (OCR 4721, Jan 2005, Q1i,ii)(i) Express 11^{-2} as a fraction.

[1]

(ii) Evaluate $100^{\frac{3}{2}}$.

[2]

i/ $11^{-2} = \frac{1}{11^2} = \frac{1}{121}$

ii/ $100^{\frac{3}{2}} = 10^3 = 1000$

Q10, (OCR 4721, Jun 2005, Q5a,b)(a) Simplify $2x^{\frac{2}{3}} \times 3x^{-1}$.

[2]

(b) Express $2^{40} \times 4^{30}$ in the form 2^n .

[2]

a/ $2x^{\frac{2}{3}} \times 3x^{-1} = 6x^{-\frac{1}{3}}$

b/ $2^{40} \times 4^{30} = 2^{40} \times (2^2)^{30} = 2^{40} \times 2^{60} = 2^{100}$

Q11, (OCR 4721, Jun 2006, Q2i,ii)(i) Evaluate $27^{-\frac{2}{3}}$.

[2]

(ii) Express $5\sqrt{5}$ in the form 5^n .

[1]

i/ $27^{-\frac{2}{3}} = \left(\frac{1}{27}\right)^{\frac{2}{3}} = \left(\frac{1}{3}\right)^2 = \frac{1}{9}$

ii/ $5\sqrt{5} = 5^1 \times 5^{\frac{1}{2}} = 5^{\frac{3}{2}}$

Q12, (OCR 4721, Jan 2007, Q2)

Evaluate

(i) 6^0 ,

[1]

(ii) $2^{-1} \times 32^{\frac{4}{5}}$.

[3]

i/ $6^0 = 1$

ii/ $2^{-1} \times 32^{\frac{4}{5}} = \frac{1}{2} \times 2^4 = \frac{1}{2} \times 16 = 8$

Q13, (OCR 4721, Jan 2008, Q3)

Solve the equations

(i) $10^p = 0.1$,

[1]

(ii) $(25k^2)^{\frac{1}{2}} = 15$,

[3]

(iii) $t^{-\frac{1}{3}} = \frac{1}{2}$.

[2]

i/ $10^p = 0.1 = \frac{1}{10}$

$\Rightarrow p = -1$

ii/ $(25k^2)^{\frac{1}{2}} = 15 \Rightarrow 25k^2 = 225$

$\Rightarrow k^2 = 9 \Rightarrow k = \pm 3$

iii/ $t^{-\frac{1}{3}} = \frac{1}{2} \Rightarrow t^{\frac{1}{3}} = 2 \Rightarrow \sqrt[3]{t} = 2$

$\Rightarrow t = 2^3 = 8$

Q14, (OCR 4721, Jan 2009, Q2)

Simplify

(i) $(\sqrt[3]{x})^6$,

[1]

(ii) $\frac{3y^4 \times (10y)^3}{2y^5}$.

[3]

i/ $(\sqrt[3]{x})^6 = (x^{\frac{1}{3}})^6 = x^2$

ii/ $\frac{3y^4 \times (10y)^3}{2y^5} = \frac{3y^4 \times 1000y^3}{2y^5} = \frac{3000y^7}{2y^5} = 1500y^2$