POWERS AND ROOTS

DATE OF SOLUTIONS: 15/05/2018
MAXIMUM MARK: 59

SOLUTIONS

GCSE (+ IGCSE) EXAM QUESTION PRACTICE

1. [Edexcel, 2014] Powers and Roots **[3 Marks]**

(a) Write $3 \times 3 \times 3 \times 3 \times 3$ as a single power of 3

3^5 A1

(1)

(b) Write $\frac{7^5 \times 7^9}{7^6}$ as a single power of 7

M1 $\frac{7^{14}}{7^6} = 7^8$

7^8 A1

(2)

2. [Edexcel, 2012] Powers and Roots **[4 Marks]**

(a) Write $2^3 \times 2^6$ as a single power of 2

2^9 A1

(1)

(b) Write $\frac{3^9}{3^4}$ as a single power of 3

3^5 A1

(1)

(c) $\frac{5^n}{5^4 \times 5^6} = 5^3$

Find the value of n.

$\frac{5^n}{5^{10}} = 5^3 \Rightarrow n - 10 = 3$

$n = 13$

M1

(EITHER)

$n =$ 13 A1

(2)

3. [Edexcel, 2014] Powers and Roots **[3 Marks]**

(a) Write $2^3 \times 2^4$ as a single power of 2

B1

2^7

(1)

(b) $280 = 2^n \times 5 \times 7$

Find the value of n.

$2^n = \frac{280}{5 \times 7}$

$\Rightarrow 2^n = 8$ → $n = 3$

M1

A1

$n = 3$

(2)

4. [Edexcel, 2007] Powers and Roots **[4 Marks]**

(a) Simplify, leaving your answers in index form,

(i) $7^5 \times 7^3$

7^8 B1

.....

(ii) $5^9 \div 5^3$

$\frac{5^9}{5^3}$

5^6 B1

.....

(2)

(b) Solve $\frac{2^9 \times 2^4}{2^n} = 2^8$

$9+4-n=8$ M1

$\Rightarrow 13-n=8$

$\Rightarrow n=13-8$

$=5$

$n =$ 5 A1

.....

(2)

5. [Edexcel, 2013] Powers and Roots **[4 Marks]**

(a) Simplify, leaving your answers in index form,

(i) $6^5 \times 6^2 \times 6$

6^8 B1

(ii) $(9^7)^2$

9^{14} B1

(2)

(b) $\frac{5^n \times 5^3}{5^6} = 5^4$

Find the value of n.

$5^n \times 5^3 = 5^4 \times 5^6$ M1 → $n + 3 = 10$

$5^n \times 5^3 = 5^{10}$

$n =$ 7 A1

(2)

6. [Edexcel, 2004] Powers and Roots **[3 Marks]**

(a) Simplify, leaving your answer in index form

(i) $2^4 \times 2^3$

2^7 B1

(ii) $3^8 \div 3^2$

$\frac{3^8}{3^2}$

3^6 B1

(2)

(b) $5^x = 1$

Find the value of x.

(ANYTHING)^0 = 1

$1^0 = 1$

$2^0 = 1$

$3^0 = 1$

$4^0 = 1$

$5^0 = 1$

ETC!

$x =$ 0 B1

(1)

7. [Edexcel, 2006] Powers and Roots **[3 Marks]**

Evaluate the following.
Give your answers as fractions.

(a) 2^{-3}

$\frac{1}{8}$ B1

.....

(1)

(b) $\left(\frac{27}{343}\right)^{\frac{1}{3}} = \frac{\sqrt[3]{27}}{\sqrt[3]{343}}$

$\frac{3}{7}$ B1

.....

(1)

(c) $\left(\sqrt{\frac{3}{8}}\right)^4 = \left(\frac{3}{8}\right)^{\frac{1}{2}\times 4}$

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

$\frac{9}{64}$ B1

.....

(1)

8. [Edexcel, 2008] Powers and Roots **[5 Marks]**

(a) Find the value of $\left(9^{\frac{1}{2}}\right)^4$

$= 9^{\frac{1}{2} \times 4}$

$= 9^2$

81 B1

.....

(1)

(b) Express 5^{20} as a power of 25

$5^{20} = (5^2)^{10} = 25^{10}$ M1

25^{10} A1

.....

(2)

(c) Express $\sqrt{8}$ as a power of 2

$\sqrt{8} = 8^{\frac{1}{2}} = (2^3)^{\frac{1}{2}}$

M1 $= 2^{\frac{3}{2}}$

$2^{\frac{3}{2}}$ A1

.....

(2)

9. [Edexcel, 2016] Powers and Roots **[5 Marks]**

(a) Simplify $\left(4h^{\frac{2}{3}}\right)^3$

$= 4^3 \times h^{\frac{2}{3}\times 3}$

$= 64 \times h^2$

B1 B1

$64h^2$

(2)

$\frac{a\sqrt{a}}{\sqrt[3]{a^2}} = a^k$

(b) Work out the value of k.

$\frac{a^1 \times a^{\frac{1}{2}}}{a^{\frac{2}{3}}} = \frac{a^{\frac{3}{2}}}{a^{\frac{2}{3}}} = a^{\frac{3}{2}-\frac{2}{3}} = a^{\frac{5}{6}}$

M1

$k = \frac{5}{6}$ A1

(3)

10. [Edexcel, 2006] Powers and Roots **[7 Marks]**

(a) Express $8^{\frac{1}{2}}$ as a power of 2

$= (2^3)^{\frac{1}{2}} = 2^{\frac{3}{2}}$ M1

$2^{1.5}$ A1

(2)

(b) Express $\sqrt{3}$ as a power of 9

$= 3^{\frac{1}{2}} = (9^{\frac{1}{2}})^{\frac{1}{2}} = 9^{\frac{1}{4}}$ B1

$9^{\frac{1}{4}}$ A1

(2)

(c) Express $\frac{1}{4\sqrt{2}}$ as a power of 2

$= \frac{1}{2^2 \times 2^{\frac{1}{2}}}$ B1 $= \frac{1}{2^{2.5}}$ B1 $= 2^{-2.5}$

$2^{-2.5}$ A1

(3)

11. [New Question, by Maths4Everyone.com] Powers and Roots **[7 Marks]**

(a) (i) Write down the value of 10^0.

1 A1

(ii) Write down the value of 10^{-2}.

$\frac{1}{10^2}$

$\frac{1}{100}$ OR 0.01 A1

(2)

(b) (i) Write 8 as a power of 2

2^3 A1

(ii) Write 2 as a power of 8

$8^{\frac{1}{3}}$ A1

(iii) Write $\frac{1}{4}$ as a power of 2

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

2^{-2} A1

(3)

(c) Evaluate $\left(\frac{27}{343}\right)^{\frac{2}{3}}$

$= \left(\sqrt[3]{\frac{27}{343}}\right)^2$

$= \left(\frac{3}{7}\right)^2$ M1

$= \frac{9}{49}$

$\frac{9}{49}$ A1

(2)

Solve $3 \times 4^{2k+8} = 24$
Show your working clearly.

$3 \times 4^{2k+8} = 24 \Rightarrow 4^{2k+8} = 8$ (M1)

$\Rightarrow (2^2)^{2k+8} = 2^3$

$\Rightarrow 2^{4k+16} = 2^3$

$\Rightarrow 4k+16 = 3$ (M1)

$4k = -13$

$k = -\frac{13}{4}$

$= -3.25$ (A1)

13. [Edexcel, 2016] Powers and Roots **[3 Marks]**

$y = 16 \times 10^{8k}$ where k is an integer.

Find an expression, in terms of k, for $y^{\frac{5}{4}}$

Give your answer in standard form.

$$\left(16 \times 10^{8k}\right)^{\frac{5}{4}} = 16^{\frac{5}{4}} \times 10^{8k \times \frac{5}{4}}$$

$$= \left(\sqrt[4]{16}\right)^5 \times 10^{10k} \quad \text{B1}$$

$$= 2^5 \times 10^{10k}$$

$$= 32 \times 10^{10k} \quad \text{B1}$$

$$= 3.2 \times 10^{10k+1} \quad \text{A1}$$

14. [Edexcel, 2009] Powers and Roots **[4 Marks]**

(a) $(\sqrt{a})^7 = k\sqrt{a}$, where $k = a^n$

Find the value of n.

$a^{\frac{1}{2}\times 7} = a^n \times a^{\frac{1}{2}}$ (M1)

$\Rightarrow a^{3.5} = a^{n+0.5}$

$\Rightarrow 3.5 = n + 0.5$

$n = 3.5 - 0.5$

$= 3$ (A1)

(b) Express $\frac{1}{2\sqrt{2}}$ as a power of 2

$\frac{1}{2 \times 2^{\frac{1}{2}}} = \frac{1}{2^{2.5}}$

(M1)

$= 2^{-2.5}$ (A1)

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Note that some questions contain the words 'show that', 'show your working out', or similar. These questions require working out to be shown. Failure to show sufficient working out is likely to result in no marks being awarded, even if the final answer is correct.

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