## **POWERS AND ROOTS**

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

## **SOLUTIONS**

GCSE (+ IGCSE) EXAM QUESTION PRACTICE

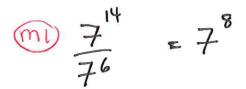
1. [Edexcel, 2014]

Powers and Roots [3 Marks]

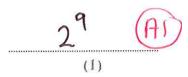
(a) Write  $3 \times 3 \times 3 \times 3 \times 3$  as a single power of 3



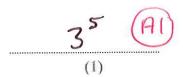
(b) Write  $\frac{7^5 \times 7^9}{7^6}$  as a single power of 7



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

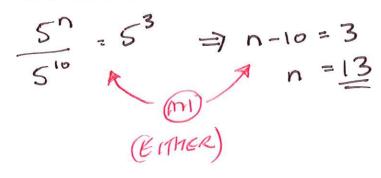


(b) Write  $\frac{3^9}{3^4}$  as a single power of 3



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

Find the value of n.



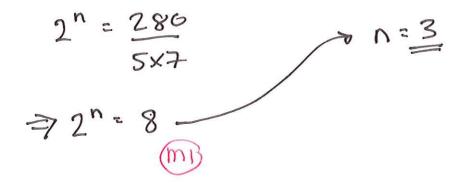
$$n = \frac{13}{(2)}$$

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



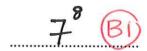
(b) 
$$280 = 2^n \times 5 \times 7$$

Find the value of n.



$$n = \frac{3}{(2)}$$

- (a) Simplify, leaving your answers in index form,
  - (i)  $7^5 \times 7^3$



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

5 6 B)

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

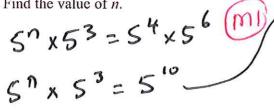
$$9+4-n=8$$
 mi  
 $\Rightarrow 13-n=8$   
 $\Rightarrow n=13-8$   
 $= 5$ 

- (a) Simplify, leaving your answers in index form,
  - (i)  $6^5 \times 6^2 \times 6$

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

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

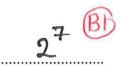
Find the value of n.



n+3=

$$n = \mathcal{F}$$
 (2)

- (a) Simplify, leaving your answer in index form
  - (i)  $2^4 \times 2^3$



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

(b) 
$$5^x = 1$$

Find the value of x.



$$x = \frac{\mathbf{B}}{\mathbf{B}}$$

Evaluate the following. Give your answers as fractions.

(a)  $2^{-3}$ 

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

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

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

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

(b) Express 5<sup>20</sup> as a power of 25

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

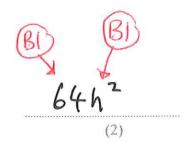
(c) Express  $\sqrt{8}$  as a power of 2

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

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

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

$$= 64 \times h^2$$



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

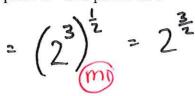
(b) Work out the value of 
$$k$$
.

Work out the value of 
$$k$$
.

$$\frac{Q' \times Q'^2}{Q'^3} = \frac{Q'^2}{Q'^3} = \frac{Q'^2}{Q'$$

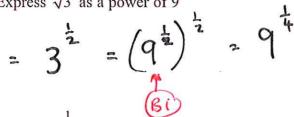
$$k = \frac{5}{6}$$

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



2 (2)

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



9 4 (1)

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

$$= \frac{1}{2^2 \times 2^{\frac{1}{2}}} = \frac{1}{2^{2 \cdot 5}} = 2^{-2 \cdot 5}$$
(B1)

2 (3)

(a) (i) Write down the value of 100.



(ii) Write down the value of 10<sup>-2</sup>.



100 OR 0.01

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

2<sup>3</sup> (A)

(ii) Write 2 as a power of 8

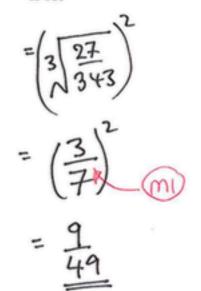
8 3 A

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

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

2<sup>-2</sup> (A)

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



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

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

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

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

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

$$\Rightarrow 4k+16 = 3$$

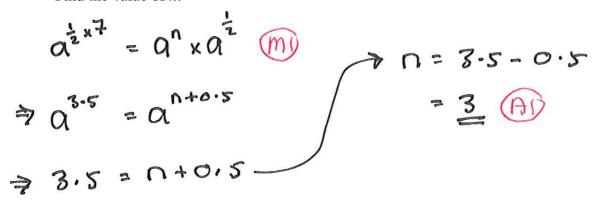
$$4k = -13$$

$$k = -13$$

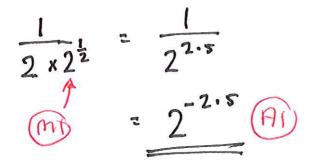
 $y = 16 \times 10^{8k}$  where k is an integer.

Find an expression, in terms of k, for  $y^{\overline{4}}$ Give your answer in standard form.

(a)  $(\sqrt{a})^7 = k\sqrt{a}$ , where  $k = a^n$ Find the value of n.



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



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Within these solutions there is an indication of where marks <u>might</u> be awarded for each question. B marks, M marks and A marks have been used in a similar, but <u>not identical</u>, way that an exam board uses these marks within their mark schemes. This slight difference in the use of these marking symbols has been done for simplicity and convenience. Sometimes B marks, M marks and A marks have been interchanged, when compared to an examiners' mark scheme and sometimes the marks have been awarded for different aspects of a solution when compared to an examiners' mark scheme.

- B1 This is an unconditional accuracy mark (the specific number, word or phrase must be seen. This type of mark cannot be given as a result of 'follow through').
- M1 This is a method mark. Method marks have been shown in places where they might be awarded for the method that is shown. If You use a different method to get a correct answer, then the same number of method marks would be awarded but it is not practical to show all possible methods, and the way in which marks might be awarded for their use, within these particular solutions. When appropriate, You should seek clarity and download the relevant examiner mark scheme from the exam board's web site.
- A1 These are accuracy marks. Accuracy marks are typically awarded after method marks. If the correct answer is obtained, then You should normally (but not always) expect to be awarded all of the method marks (provided that You have shown a method) and all of the accuracy marks.

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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