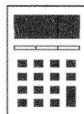


# GCSE MATHEMATICS

## Indices 1



**AQA** These questions have been taken or modified from previous AQA GCSE Mathematics Papers.

### Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer all questions.
- You must answer the questions in the spaces provided.
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.14 unless another value is given in the question.

### Information

- The marks for questions are shown in brackets.
- The quality of your written communication is specifically assessed in questions that are indicated with an asterisk (\*).

### Advice

- Read each question carefully before you start to answer it.
- In all calculations, show clearly how you work out your answer.
- Use the number of marks for the question as a guide to the amount of time you need to spend.
- Look at previous parts of the question, e.g. a), b), c) i) as there may be information there you need to answer later parts.
- Check your answer is realistic and appropriate.
- For calculator decimal numbers always write your full calculator display in the working out area and then, if you need to, round the answer on the answer line.

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1 Simplify  $(2x^5y)^3$

Answer  $8x^{15}y^3$  [2 marks]

2  $x$  is a number between 0 and 1.

Write the following in numerical order, starting with the smallest.

$\sqrt{x}$      $x^2$      $x^0$      $\frac{1}{x}$      $x$

Answer  $x^2, x, \sqrt{x}, x^0, \frac{1}{x}$  [2 marks]

3  $x$  is a number greater than 1.

Write the following in numerical order starting with the smallest.

$\frac{1}{x}$      $x^{-2}$      $x^{\frac{1}{2}}$      $x^3$

Answer  $x^{-2}, \frac{1}{x}, x^{\frac{1}{2}}, x^3$  [2 marks]

4 Find two sets of values for  $c$  and  $d$  such that

$$16^c = 2^d$$

$$c=2, d=8$$
$$c=0, d=0$$

+ more

Examples

$$c = \frac{1}{2} \text{ and } d = 2$$

$$\text{or } c = \frac{1}{4} \text{ and } d = 1$$

[3 marks]

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

Answer

$$\frac{1}{27}$$

[2 marks]

5 (b) Work out all solutions of the equation

$$8^m = 2^{m^2}$$
$$(2^3)^m = 2^{m^2}$$
$$2^{3m} = 2^{m^2}$$
$$\therefore m^2 = 3m$$
$$m^2 - 3m = 0$$
$$m(m-3) = 0$$

Answer

$$m=0 \text{ or } m=3$$

[3 marks]

6

A microscope slide has  $2^8$  bacteria on it.  
The number of bacteria doubles every hour.

After how many hours are there  $8^4$  bacteria on the slide?

$$8^4 = (2^3)^4 = 2^{12} \quad [3 \text{ marks}]$$

$$2^8 \times 2^x = 2^{12}$$
$$x = 4$$

Answer

$$4$$

hours

7

$$16^{-\frac{1}{4}} = n^{\frac{1}{3}}$$

Work out the value of  $n$ .

$$(16^{-1})^{\frac{1}{4}} = \left(\frac{1}{16}\right)^{\frac{1}{4}} = \frac{1}{2} \quad [2 \text{ marks}]$$

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

Answer

$$\frac{1}{8}$$

8

$$8^{\frac{2}{3}} \times 2^{-2} = 4^x$$

Work out the value of  $x$ .  
You **must** show your working.

[4 marks]

$$8^{\frac{2}{3}} = 4$$
$$2^{-2} = \frac{1}{4}$$

$$4 \times \frac{1}{4} = 4^x$$
$$1 = 4^x$$
$$x = 0$$

Answer            $x = 0$           

9 (a) Complete this table.

|       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|
| $3^0$ | $3^1$ | $3^2$ | $3^3$ | $3^4$ | $3^5$ | $3^6$ | $3^7$ |
| 1     | 3     | 9     | 27    | 81    | 243   | 729   | 2187  |

(2 marks)

$$3^6 \times 3^7$$
 Add the powers

9 (b)

$$729 \times 2187 = 1\,594\,323$$

and

$$1\,594\,323 = 3^x$$

Use the table to work out the value of  $x$ .

$$x = \dots\dots\dots 3^{13} \dots\dots\dots$$
 (1 mark)

9 (c)

Use the table, or otherwise, to work out  $\frac{2187}{9}$   
Give your answer as a power of 3.

$$\frac{3^7}{3^2}$$
 Subtract the powers

$$\text{Answer } \dots\dots\dots 3^5 \dots\dots\dots$$
 (1 mark)