Name: SOLUTIONS

GCSE (1 - 9) Fractional and Negative Indices	Solutions:

These questions represent all of the times that this topic has appeared in unlocked Pearson Edexcel GCSE maths papers as of July 2023. More questions can be found at examq.co.uk

Question	Where the question appeared
1	Edexcel, GCSE, Autumn 2017, Paper 1H, Q10
2	Edexcel, GCSE, Autumn 2017, Paper 2H, Q6
3	Edexcel, GCSE, Autumn 2018, Paper 1H, Q1
4	Edexcel, GCSE, Autumn 2018, Paper 1H, Q14
5	Edexcel, GCSE, Autumn 2018, Paper 3H, Q9
6	Edexcel, GCSE, Autumn 2019, Paper 1H, Q7
7	Edexcel, GCSE, Autumn 2019, Paper 1H, Q19
8	Edexcel, GCSE, Autumn 2020, Paper 1H, Q11
9	Edexcel, GCSE, Autumn 2020, Paper 2H, Q10
10	Edexcel, GCSE, Autumn 2020, Paper 3H, Q1
11	Edexcel, GCSE, Summer 2017, Paper 1H, Q11
12	Edexcel, GCSE, Summer 2017, Paper 2H, Q18
13	Edexcel, GCSE, Summer 2018, Paper 1H, Q9
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15	Edexcel, GCSE, Summer 2019, Paper 1H, Q8
16	Edexcel, GCSE, Summer 2019, Paper 3H, Q12

1

(a) Write down the value of $100^{\frac{1}{2}}$

$100^{\frac{1}{2}} = \sqrt{100} = 10$

(1)

(b) Find the value of $125^{\frac{2}{3}}$

$125^{\frac{2}{3}} = \left(\sqrt[3]{125}\right)^2 = 5^2 = 25$

(2)

(Total for Question 10 is 3 marks)

[Edexcel, GCSE, Autumn 2017, Paper 1H, Q10]

2

$p^3 \times p^x = p^9$

(a) Find the value of x.

$3 + x = 9$

$x = 6$

$x =$ 6

(1)

$(7^2)^y = 7^{10}$

(b) Find the value of y.

$(7^2)^y = 7^{2y}$

$2y = 10$

$y = 5$

$y =$ 5

(1)

$100^a \times 1000^b$ can be written in the form 10^w

(c) Show that $w = 2a + 3b$

$100^a = (10^2)^a = 10^{2a}$

$1000^b = (10^3)^b = 10^{3b}$

$10^{2a} \times 10^{3b} = 10^{2a+3b}$

(2)

(Total for Question 6 is 4 marks)

[Edexcel, GCSE, Autumn 2017, Paper 2H, Q6]

3

Work out the value of $\dfrac{3^7 \times 3^{-2}}{3^3}$

$$\frac{3^7 \times 3^{-2}}{3^3} = \frac{3^5}{3^3} = 3^2$$

.....

(Total for Question 1 is 2 marks)

[Edexcel, GCSE, Autumn 2018, Paper 1H, Q1]

4

(a) Work out the value of $\left(\dfrac{16}{81}\right)^{\frac{3}{4}}$

$$\left(\frac{16}{81}\right)^{\frac{3}{4}} = \left(\frac{\sqrt[4]{16}}{\sqrt[4]{81}}\right)^3 = \left(\frac{2}{3}\right)^3 = \frac{8}{27}$$

.....

(2)

$3^a = \dfrac{1}{9}$ $\quad 3^b = 9\sqrt{3}$ $\quad 3^c = \dfrac{1}{\sqrt{3}}$

(b) Work out the value of $a + b + c$

$$\frac{1}{9} = 3^{-2} \qquad 9\sqrt{3} = 3^2 \times 3^{\frac{1}{2}} = 3^{\frac{5}{2}} \qquad \frac{1}{\sqrt{3}} = 3^{-\frac{1}{2}}$$

$$a + b + c$$

$$-2 + \frac{5}{2} + -\frac{1}{2} = 0$$

0

.....

(2)

(Total for Question 14 is 4 marks)

[Edexcel, GCSE, Autumn 2018, Paper 1H, Q14]

5

(a) Expand and simplify $(x - 2)(2x + 3)(x + 1)$

$(2x+3)(x-2) = 2x^2 - x - 6$

$(x+1)(2x^2 - x - 6) =$

$2x^3 - x^2 - 6x$

$+2x^2 - x - 6$

$2x^3 + x^2 - 7x - 6$

(3)

$\frac{y^4 \times y^n}{y^2} = y^{-3}$

(b) Find the value of n.

$\frac{y^4 \times y^n}{y^2} = y^{-3}$

$4 + n - 2 = -3$

$n + 2 = -3$

$n = -5$

(2)

(c) Solve $5x^2 - 4x - 3 = 0$

Give your solutions correct to 3 significant figures.

$a = 5$ $b = -4$ $c = -3$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{4 \pm \sqrt{(-4)^2 - 4 \times 5 \times (-3)}}{2(5)}$

$x = 1.27$ $x = -0.472$

(3)

(Total for Question 9 is 8 marks)

[Edexcel, GCSE, Autumn 2018, Paper 3H, Q9]

6

(a) Simplify $(p^2)^5$

$(p^2)^5 = p^{2\times5} = p^{10}$

(1)

(b) Simplify $12x^7y^3 \div 6x^3y$

$12x^7y^3 \div 6x^3y^1 = 2x^4y^2$

(2)

(Total for Question 7 is 3 marks)

[Edexcel, GCSE, Autumn 2019, Paper 1H, Q7]

7

Given that $9^{-\frac{1}{2}} = 27^{\frac{1}{4}} \div 3^{x+1}$
find the exact value of x.

$9^{-1/2} = (3^2)^{-1/2} = 3^{-1}$

$27^{1/4} = (3^3)^{1/4} = 3^{3/4}$

$3^{-1} = 3^{3/4} \div 3^{x+1}$

$-1 = 3/4 - (x+1)$

$-1 = -1/4 - x$

$-3/4 = -x$

$3/4 = x$

$x = 3/4$

(Total for Question 19 is 3 marks)

[Edexcel, GCSE, Autumn 2019, Paper 1H, Q19]

8

(a) Find the value of $\sqrt[4]{81 \times 10^8}$

$\sqrt[4]{81 \times 10^8} = \sqrt[4]{81} \times \sqrt[4]{10^8}$

$= 3 \times (10^8)^{1/4}$

$= 3 \times 10^2$

$= 3 \times 100 = 300$

(2)

(b) Find the value of $64^{-\frac{1}{2}}$

$64^{-1/2} = \left(\frac{1}{64}\right)^{1/2} = \frac{\sqrt{1}}{\sqrt{64}} = \frac{1}{8}$

(2)

(c) Write $\frac{3^n}{9^{n-1}}$ as a power of 3

$\frac{3^n}{9^{n-1}} = \frac{3^n}{(3^2)^{n-1}} = \frac{3^n}{3^{2n-2}} = 3^{n-(2n-2)}$

$n-(2n-2) = -n+2$

$= 3^{2-n}$

(2)

(Total for Question 11 is 6 marks)

[Edexcel, GCSE, Autumn 2020, Paper 1H, Q11]

9

(a) Simplify $\left(\frac{1}{m^2}\right)^0$

1

(1)

(b) Simplify $\frac{8(x-4)}{(x-4)^2}$

$$\frac{8(x-4)}{(x-4)(x-4)} = \frac{8}{x-4}$$

(1)

(c) Simplify $(3n^4w^2)^3$

$$(3^3) \times (n^4)^3 \times (w^2)^3 = 27n^{12}w^6$$

(2)

(Total for Question 10 is 4 marks)

[Edexcel, GCSE, Autumn 2020, Paper 2H, Q10]

10

(a) Simplify $n^3 \times n^5$

$n^3 \times n^5 = n^{3+5} = n^8$

(1)

(b) Simplify $\frac{c^3d^4}{c^2d}$

$\frac{c^3d^4}{c^2d^1} = cd^3$

(2)

(c) Solve $\frac{5x}{2} > 7$

$\frac{5x}{2} > 7$

$5x > 14$

$x > \frac{14}{5}$

$x > 2 \cdot 8$

(2)

(Total for Question 1 is 5 marks)

[Edexcel, GCSE, Autumn 2020, Paper 3H, Q1]

11

(a) Find the value of $81^{-\frac{1}{2}}$

$81^{-\frac{1}{2}} = \left(\frac{1}{81}\right)^{\frac{1}{2}} = \frac{\sqrt{1}}{\sqrt{81}} = \frac{1}{9}$

(2)

(b) Find the value of $\left(\frac{64}{125}\right)^{\frac{2}{3}}$

$\left(\frac{64}{125}\right)^{\frac{2}{3}} = \left(\frac{\sqrt[3]{64}}{\sqrt[3]{125}}\right)^{2} = \left(\frac{4}{5}\right)^{2} = \frac{16}{25}$

(2)

(Total for Question 12 is 4 marks)

[Edexcel, GCSE, Summer 2017, Paper 1H, Q11]

12

$16^{\frac{1}{5}} \times 2^{x} = 8^{\frac{3}{4}}$

Work out the exact value of x.

$16^{\frac{1}{5}} = (2^4)^{\frac{1}{5}} = 2^{4/5}$

$8^{\frac{3}{4}} = (2^3)^{\frac{3}{4}} = 2^{9/4}$

$2^{4/5} \times 2^{x} = 2^{9/4}$

$\frac{4}{5} + x = \frac{9}{4}$

$x = \frac{9}{4} - \frac{4}{5}$

$x = \frac{45}{20} - \frac{16}{20} = \frac{29}{20}$

$x = \frac{29}{20}$

$x = \frac{29}{20} = 1.45$

(Total for Question 18 is 3 marks)

[Edexcel, GCSE, Summer 2017, Paper 2H, Q18]

13

(a) Write down the value of $36^{\frac{1}{2}}$

$36^{\frac{1}{2}} = \sqrt{36} = 6$

(1)

(b) Write down the value of 23^0

1

(1)

(c) Work out the value of $27^{-\frac{2}{3}}$

$27^{-\frac{2}{3}} = \left(\frac{1}{27}\right)^{\frac{2}{3}} = \left(\frac{\sqrt[3]{1}}{\sqrt[3]{27}}\right)^2 = \left(\frac{1}{3}\right)^2 = \frac{1}{9}$

(2)

(Total for Question 9 is 4 marks)

[Edexcel, GCSE, Summer 2018, Paper 1H, Q9]

14

(a) Simplify $m^3 \times m^4$

$m^3 \times m^4 = m^{3+4}$

m^7

(1)

(b) Simplify $(5np^3)^3$

$(5)^3 \times (n^1)^3 \times (p^3)^3 = 125n^3p^9$

(2)

(c) Simplify $\frac{32q^9r^4}{4q^3r}$

$\frac{32q^9r^4}{4q^3r^1} = 8q^6r^3$

(2)

(Total for Question 1 is 5 marks)

[Edexcel, GCSE, Summer 2018, Paper 2H, Q1]

15

(a) Work out an estimate for the value of $\sqrt{63.5 \times 101.7}$

$\sqrt{63.5 \times 101.7} = \sqrt{63.5} \times \sqrt{101.7}$

$\approx \sqrt{64} \times \sqrt{100}$

$8 \times 10 = 80$

(2)

$(2.3)^6 = 148$ correct to 3 significant figures.

(b) Find the value of $(0.23)^6$ correct to 3 significant figures.

$(2.3)^6 = 148$

$(0.23)^6 = 0.000148$

0.000148

(1)

(c) Find the value of 5^{-2}

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

(1)

(Total for Question 8 is 4 marks)

[Edexcel, GCSE, Summer 2019, Paper 1H, Q8]

16

Patrick has to work out the exact value of $64^{\frac{1}{4}}$

Patrick says,

"$\frac{1}{4}$ of 64 is 16 so $64^{\frac{1}{4}} = 16$"

Explain what is wrong with what Patrick says.

$64^{1/4}$ means $\sqrt[4]{64} \approx 2{\cdot}828$

(Total for Question 12 is 1 mark)

[Edexcel, GCSE, Summer 2019, Paper 3H, Q12]