ANSWERS

Indices and Logs

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Core 1 - Bronze

Topic: Indices and Logs

Question 1

c) Simplify $\frac{2}{(1+\sqrt{5})}$

$\times \frac{(1-\sqrt{5})}{(1-\sqrt{5})} = \frac{2-2\sqrt{5}}{1-\sqrt{5}+\sqrt{5}-5} = \frac{2-2\sqrt{5}}{-4}$

$= \frac{2}{-4} - \frac{2\sqrt{5}}{-4} = -\frac{1}{2} + \frac{1}{2}\sqrt{5}$

$= \frac{1}{2}\sqrt{5} - \frac{1}{2}$

$= \frac{\sqrt{5}-1}{2}$

d) Simplify $\frac{2}{(3\sqrt{2}-1)}$

$\times \frac{(3\sqrt{2}+1)}{(3\sqrt{2}+1)} = \frac{6\sqrt{2}+2}{18+3\sqrt{2}-3\sqrt{2}-1}$

$= \frac{6\sqrt{2}+2}{17}$

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Core 2 - Bronze

Topic: Indices and Logs

Question 2

Work out the value of x

a) $2^{x} = \frac{1}{8}$ $= 2^{-3} = \frac{1}{8}$

Hence work out the value of $a + b + c$

b) $2^{a} = \frac{1}{8}$, $2^{b} = 8\sqrt{2}$, $2^{c} = \frac{1}{2\sqrt{2}}$ $= -1$

$a = -3$, $2^{3} \times 2^{\frac{1}{2}} = 2^{3.5}$, $\frac{1}{2^{1} \times 2^{\frac{1}{2}}} = \frac{1}{2^{1.5}}$

$b = 3.5$ $c = -1.5$

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Core 3 - Bronze Topic: Indices and Logs

$\log_a(b) = x \Rightarrow a^x = b$

Question 3

Simplify

a) $\log_3 3 + \log_3 9 =$

$\log_3(x) + \log_3(y) = \log_3(xy) = \log_3(27) = x$

$3^x = 27 \therefore x = 3$

b) $\log_2 12 - \log_2 3 =$

$\log_3\left(\frac{12}{3}\right) = \log_3 4$

c) $\log 3^x =$

$x \log 3$

Work out the value of x

d) $\log_2 x = 3$

$2^3 = 8 \therefore x = 8$

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Core 4 - Bronze Topic: Indices and Logs

Question 4

Work out the value of x

a) $3^3 \times 9 = 3^x$

$3^3 \times 3^2 = 3^x \quad 3+2 = x \therefore x = 5$

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

$\left(2^{\frac{4}{1}}\right)^{\frac{1}{5}} \times (2)^x = \left(2^{\frac{3}{1}}\right)^{\frac{3}{4}}, \quad 2^{\frac{4}{5}} \times 2^x = 2^{\frac{9}{4}}$

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

$x = \frac{9}{4} - \frac{4}{5}, \quad \frac{45-16}{20}$

$= \frac{29}{20}$

$= 1\frac{9}{20}$

c) $4^{(2x-4)} = 8^{(x+2)}$

$\left(2^2\right)^{(2x-4)} = \left(2^3\right)^{(x+2)}, \quad 2^{4x-8} = 2^{3x+6}$

$4x - 8 = 3x + 6$

$x = 14$

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Core 5 - Bronze

Topic: Indices and Logs

Question 5

Show that $\dfrac{2-4\sqrt{2}}{2+2\sqrt{2}}$ can be simplified to $3\sqrt{2}-5$

$$\frac{(2-4\sqrt{2})}{(2+2\sqrt{2})} \times \frac{(2-2\sqrt{2})}{(2-2\sqrt{2})} = \frac{4-4\sqrt{2}-8\sqrt{2}+[8\times 2]}{4-2\sqrt{2}+2\sqrt{2}-[4\times 2]}$$

$$= \frac{4-12\sqrt{2}+16}{4-8} \qquad = \frac{20-12\sqrt{2}}{-4}$$

$$= \frac{20}{-4} + 3\sqrt{2}$$

$$= 3\sqrt{2}-5$$

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Core 6 - Silver **Topic:** Indices and Logs

Question 6

Work out the value of n

a) $n\log_3 81 = \log_2 8$

$$n\log_3(81) = \log_2(8)$$

$$n\log_3(3)^4 = \log_2(2)^3$$

$$4n\log_3(3) = 3\log_2(2)$$

$$4n = 3$$

$$n = \frac{3}{4}$$

Silver

Core 7 - Silver Topic: Indices and Logs

Question 7

Work out the value of y

a) $\log_3(4y-2) - 2 = \log_3(y+2)$

$\log_3(4y-2) - \log_3(y+2) = 2$

$\log_3\left(\frac{4y-2}{y+2}\right) = 2$

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

$\frac{9}{1} = \frac{4y-2}{y+2}$

$9(y+2) = 4y-2$

$9y+18 = 4y-2$

$9y-4y = -2-18$

$5y = -20$

$y = -4$

Silver

Core 8 - Silver Topic: Indices and Logs

Question 8

Work out the value of

a) $8^{\frac{1}{4}} \times (\sqrt{2})^{-4} \times 2^{\frac{3}{2}}$

$= (2^3)^{\frac{1}{4}} \times (2^{\frac{1}{2}})^{-4} \times 2^{\frac{3}{2}}$

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

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

$= \frac{3}{4} + \frac{-2}{1} + \frac{3}{2} = \frac{3}{4} - \frac{8}{4} + \frac{6}{4} = \frac{1}{4}$

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Core 9 - Silver Topic: Indices and Logs

Question 9

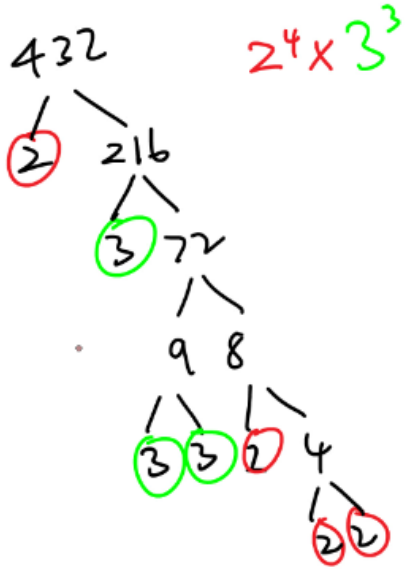
Work out the value of x and y

a) $\dfrac{2^{x-2}}{3^{3y}} = 432$

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

$2: \quad x-2 = 4 \quad \therefore x = 6$

$3: \quad -3y = 3 \quad y = -1$



$2^4 \times 3^3$

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Core 10 - Gold Topic: Indices and Logs

Question 10

Given that log3 =0.4771 and log 2 = 0.301, find the value of log(3 3/8), without using mathematical tables.

$\log\left(3\frac{3}{8}\right) = \log\left(\frac{27}{8}\right) = \log 27 - \log 8$

$= \log 3^3 - \log 2^3$

$= 3\log 3 - 3\log 2$

$= 3(0.4771) - 3(0.301)$

$= 0.5283$

Gold

Core 11- Gold Topic: Indices and Logs

Question 11

Express the expression

a) $(2)^{3y-1} + 3 \times (2)^{y+2}$

in terms of P given that $P = (2)^y$

$(2)^{3y} \times 2^{-1} + 3 \times (2)^y \times 2^2$

$\frac{1}{2}(2)^{3y} + 12(2)^y$

$= \frac{1}{2}P^3 + 12P$

Gold

Core 12 - Gold Topic: Indices and Logs

Question 12

a) Work out the value of x

$\sqrt{4^{3x-3}} + 8 = 72$

$\sqrt{4^{3x-3}} = 72 - 8$

$\sqrt{4^{3x-3}} = 64$

$4^{3x-3} = (4^3)^2$

$4^{3x-3} = 4^6$

$3x - 3 = 6$

$3x = 9$

$x = 3$

Gold

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Core 12 - Gold Topic: Indices and Logs

Question 12

a) Work out the value of x

$\sqrt{4^{3x-3}} + 8 = 72$

$\sqrt{4^{3x-3}} = 72 - 8$

$\sqrt{4^{3x-3}} = 64$

$4^{3x-3} = (4^3)^2$

$4^{3x-3} = 4^6$

$3x - 3 = 6$

$3x = 9$

$x = 3$

Gold

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Core 13 - Platinum Topic: Indices and Logs

Question 13

Evaluate $\log_{10}(13500)$ given that $\log_{10} 2 = 0.301$, $\log_{10} 3 = 0.4771$, $\log_{10} 5 = 0.699$

13500

13500 = 2x2x3x3x3x5x5x5

$\log_{10}(2 \times 2 \times 3 \times 3 \times 3 \times 5 \times 5 \times 5)$

$\log_{10}(2^2 \times 3^3 \times 5^3)$

$\log(xyz) = \log_{10}(x) + \log_{10}(y) + \log_{10}(z)$

$\log_{10} 2^2 + \log_{10} 3^3 + \log_{10} 5^3$

$2\log_{10} 2 + 3\log_{10} 3 + 3\log_{10} 5$

$= 2(0.301) + 3(0.4771) + 3(0.699)$

$= 0.602 + 1.4313 + 0.2097$

$= 4.1303$

Platinum