L2 Merit+ Exponents #3

1. Solve: $3^{x+4} = 800 \times 7^{x}$

2. Simplify: $\dfrac{49^{x+1}}{7^{x-3}}$

3. Solve: $81^{x} - 702 = 9^{x}$

4. Solve: $\dfrac{8^{x-1}}{2^{x+3}} = 64$

5. Show that if $p^{3x} = m^{x-2}$ then $x = \dfrac{2\log(m)}{\log(m) - 3\log(p)}$

6. Solve: $36^{x} \times 4^{3-2x} = 486$

7. Solve: $4^{5x} \times 256 = 8^{x^2}$

8. Solve: $5^{x+1} - 25^{\frac{x}{2}} = 2500$

Answers: Merit+ Exponents Practice #3

1. Solve: $3^{x+4} = 800 \times 7^x$ Need to combine the x terms in order to solve.

$\Rightarrow$ Solve: $3^x \times 81 = 800 \times 7^x$ $\Rightarrow \frac{81}{800} = \left(\frac{7}{3}\right)^x$ $\Rightarrow x = \frac{\log \frac{81}{800}}{\log \frac{7}{3}}$ $\Rightarrow \boldsymbol{x = -2.703}$

2. Simplify: $\frac{49^{x+1}}{7^{x-3}}$ Base 7 in common, then normal cancellation

$= \frac{7^{2x+2}}{7^{x-3}}$ $= 7^{2x+2-(x-3)}$ $\boldsymbol{= 7^{x+5}}$

3. Solve: $81^x - 702 = 9^x$ The separation by – into three terms means quadratic.

$\Rightarrow (9^x)^2 - 9^x - 702 = 0$ (as $81^x = 9^x \times 9^x$)

$\Rightarrow (9^x - 27)(9^x + 26) = 0$ $\Rightarrow 9^x = 27$ or $9^x = -26$ (not possible) $\Rightarrow \boldsymbol{x = 1.5}$

4. Solve: $\frac{8^{x-1}}{2^{x+3}} = 64$ All are powers of 2, so the easiest method is to use that.

$\Rightarrow \frac{2^{3(x-1)}}{2^{x+3}} = 2^6$ $\Rightarrow 2^{3x-3} = 2^6 \times 2^{x+3}$ $\Rightarrow 3x - 3 = 6 + x + 3$ $\Rightarrow \boldsymbol{x = 6}$

5. Show that if $p^{3x} = m^{x-2}$ then $x = \frac{2\log(m)}{\log(m) - 3\log(p)}$ Need to get to lone x's.

$\Rightarrow (p^3)^x = m^x \times m^{-2}$ $\Rightarrow m^2 = \left(\frac{m}{p^3}\right)^x$ then log both sides $\Rightarrow x = \frac{\log(m^2)}{\log\left(\frac{m}{p^3}\right)}$

$\Rightarrow x = \frac{2\log(m)}{\log(m) - \log(p^3)}$ $\Rightarrow x = \frac{2\log(m)}{\log(m) - 3\log(p)}$

6. Solve: $36^x \times 4^{3-2x} = 486$ Need the x to be alone so we can multiply to combine

$\Rightarrow 36^x \times 4^3 \times 4^{-2x} = 486$ $\Rightarrow 36^x \times \left(\frac{1}{16}\right)^x = \frac{486}{4^3}$ $\Rightarrow \left(\frac{36}{16}\right)^x = \frac{486}{64}$ $\Rightarrow \boldsymbol{x = 2.5}$

7. Solve: $4^{5x} \times 256 = 8^{x^2}$ All the bases are powers of 2. The x^2 means it is quadratic.

$\Rightarrow 2^{10x} \times 2^8 = 2^{3x^2}$ $\Rightarrow 2^{10x+8} = 2^{3x^2}$ $\Rightarrow 0 = 3x^2 - 10x - 8$

$\Rightarrow (3x + 2)(x - 4) = 0$ $\Rightarrow \boldsymbol{x = 4}$ or $\boldsymbol{\frac{-2}{3}}$

8. Solve: $5^{x+1} - 25^{\frac{x}{2}} = 2500$ Get to powers of five, then see common factor

$\Rightarrow 5^{x+1} - 5^x = 2500$ $\Rightarrow 5^x(5 - 1) = 2500$ $\Rightarrow 5^x \times 4 = 2500$

$\Rightarrow 5^x = 625$ $\Rightarrow \boldsymbol{x = 4}$