



Problem of the Week

Grade 11 and 12

A Simple System of Equations? Solution

Problem

If $2^{3x} = 16^{y+1}$ and $2x = 5y - 17$, determine the value of $x + y$.

Solution 1

For this solution we will attempt to answer the question only. We will not determine the values of x and y that generate the sum.

$$\begin{aligned}
 2^{3x} &= 16^{y+1} \\
 2^{3x} &= (2^4)^{y+1} \\
 2^{3x} &= 2^{4y+4} \\
 \therefore 3x &= 4y + 4 \quad (1) \\
 \text{But } 2x &= 5y - 17 \quad (2) \\
 (1) - (2) \quad x &= -y + 21 \\
 \text{Rearranging } x + y &= 21
 \end{aligned}$$

$\therefore x + y = 21$. Notice that the problem only asks for $x + y$, it is not necessary to find values for x and y .

Solution 2

This solution carries on from equations (1) and (2) in solution 1 to find the values of x and y , and then determines the sum.

$$\begin{aligned}
 (1) \times 5 \quad 15x &= 20y + 20 \quad (3) \\
 (2) \times 4 \quad 8x &= 20y - 68 \quad (4) \\
 (3) - (4) \quad 7x &= 88 \\
 x &= \frac{88}{7} \\
 \text{Substitute in (2)} \quad 2\left(\frac{88}{7}\right) &= 5y - 17 \\
 \text{Multiply by 7} \quad 176 &= 35y - 119 \\
 295 &= 35y \\
 y &= \frac{295}{35} = \frac{59}{7} \\
 \therefore x + y &= \frac{88}{7} + \frac{59}{7} = \frac{147}{7} = 21
 \end{aligned}$$

As before (but with much more work) $x + y = 21$.

