

KEY CONCEPTS

- Exponential equations in one variable can be solved by determining a common base.
- The solutions to exponential equations may be exact answers or approximate answers. When solutions to exponential equations cannot be easily determined by finding a common base, approximate solutions can be found using systematic trial on a scientific calculator.

Example

- a) Solve the exponential equation $2^{5x+2} = 8^x$ by determining a common base.
 b) Use substitution to verify your answer to part a).

Solution

a) $2^{5x+2} = 8^x$

Rewrite 8 using a base of 2.

$$2^{5x+2} = (2^3)^x$$

Apply the power of a power rule.

$$2^{5x+2} = 2^{3x}$$

Since the bases are equal, the exponents must be equal.

$$5x + 2 = 3x$$

Solve for x .

$$2x = -2$$

$$x = -1$$

The solution is $x = -1$.

b) For $x = -1$,

$$\text{L.S.} = 2^{5x+2} \quad \text{R.S.} = 8^x$$

$$= 2^{5(-1)+2} \quad = 8^{(-1)}$$

$$= 2^{-5+2} \quad = 8^{-1}$$

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

$$= \frac{1}{2^3}$$

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

$$\text{L.S.} = \text{R.S.}$$

Therefore, $2^{5x+2} = 8^x$ for $x = -1$.