

SOLVING EXPONENTIAL EQUATIONS

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Lesson Description

In this lesson we:

- Solve equations using the laws of exponents
- Solve simple equations involving surds



Summary

Exponential Equations

- 1 In solving exponential equations where the exponent is unknown, we will make use of the following property:

If $a^x = a^m$ then $x = m$, since base a is the same on either side of the equal sign.

- 2 Equations containing more than 1 term:

FACTORISE using the algebraic laws.

Recognise trinomials in the exponential expressions by looking at their factors:

$$1.1 \quad \left(a^{\frac{1}{2}} + b^{\frac{1}{2}}\right)^2 =$$

$$1.2 \quad \left(a^{\frac{1}{3}} + b^{\frac{1}{3}}\right)^2 =$$

$$1.3 \quad \left(a^{\frac{1}{4}} + b^{\frac{1}{4}}\right)^2 =$$

$$1.4 \quad (3^x + 1)^2 =$$

- 3 Equations containing a square root:

Isolate the square root and square both sides

For example:

$$1 - 2\sqrt{2x - 1} = 12 - x$$

Tips for Answering Questions

Analyse all the questions first and scan for the type of equations they contain.

Think through the laws which you will use and why.

For example:

What is the difference between the two questions given below?

SOLVE FOR x

$$1. \quad 3^{2x+1} - 4 \cdot 3^x = -1$$

$$2. \quad 2 \cdot 3^x + 3^x \cdot 2^{-1} = 7\frac{1}{2}$$

**Test Yourself****Question 1**

Choose the correct answer

If $3^x = 9\sqrt{3}$, then x is equal to

- A. $2\frac{1}{2}$
- B. $3\frac{1}{2}$
- C. 1,5
- D. $3\sqrt{3}$

Question 2

Choose the correct answer

If $x^{\frac{1}{3}} - 3 = 0$, then x is equal to

- A. 27
- B. $27^{\frac{1}{3}}$
- C. $9^{\frac{1}{3}}$
- D. 9

Question 3

Choose the correct answer

If $\sqrt{2-x} = x$ then

- A. $x = -2$
- B. $x = -2$ or $x = 1$
- C. $x = 1$
- D. $x = 2$ or $x = -1$

Question 4

Choose the correct answer

If $\sqrt{-x} - x = 0$ then

- A. $x = 0$ or $x = 1$
- B. $x = -1$
- C. $x = 0$ or $x = -1$
- D. $x = 0$

Question 5

Choose the correct answer

Solve for k : $\left(\frac{1}{2}\right)^{k-5} = 64$

- A. $k = -1$
- B. $k = 11$
- C. $k = 37$
- D. $k = 1$

Question 6

Choose the correct answer

Solve for a : $(3^a - 1)(2^a + 4) = 0$

- A. $a = 1$ or $a = -2$
- B. $a = 0$
- C. $a = 0$ or $a = -2$
- D. No solution

Question 7

Choose the correct answer

Solve for x : $2x - 5x^{\frac{1}{2}} - 3 = 0$

- A. $x = 3$
- B. $x = 9$
- C. $x = \frac{1}{2}$
- D. $x = \frac{1}{9}$

Question 8

Choose the correct answer

Solve for x : $x^{\frac{1}{2}} - 3x^{\frac{1}{4}} + 2 = 0$

- A. $x = 1$ or $x = 2$
- B. $x = 2$ or $x = 4$
- C. $x = 1$ or $x = 8$
- D. $x = 1$ or $x = 16$

Question 9

Choose the correct answer

$(2a^{-1} - 3b^{-1})^{-1}$ is equal to

- A. $\frac{ab}{2a-3b}$
- B. $\frac{ab}{2b-3a}$
- C. $2a + 3b$
- D. $\frac{a}{2} - \frac{b}{3}$

Question 10

Choose the correct answer

Solve for x :

$$2 \cdot 2^{x+1} + 2^{x-1} - 36 = 0$$

- A. $x = 1$
- B. $x = 2$
- C. $x = 3$
- D. $x = 4$



Improve your Skills

Question 1

Solve for x : $\sqrt{x-2} = 4-x$

Question 2

Solve for x : $3^{x^2-1} = \frac{27^{-x}}{3}$

Question 3

Solve for x : $3^x - 3^{x-2} = 24$