Solving Exponential Equations

Apr. 11/2011

Exercises: photocopied handout # 1, 3, 4, 6, 7, 8, 9

You can use algebra to determine the exact solution for an exponential equation when the powers on each side of the equation have the same base.

Otherwise, we solve using various techniques employed for solving any equation.

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Ex.1 Solve.

(a) $2^x = 16$

$2^x = 2^4$

$\boxed{x = 4}$

(b) $3^{2x} = 81$

$3^{2x} = 9^2$

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

$3^{2x} = 3^4$

$2x = 4$

$\boxed{x = 2}$

(c) $5^{2x-1} = \frac{1}{125}$ $125 = 5^3$

$5^{2x-1} = \frac{1}{5^3}$

$5^{2x-1} = 5^{-3}$

$2x - 1 = -3$

$2x = -2$

$\boxed{x = -1}$

(d) $36^{2x+4} = \sqrt{1296^x}$ $1296 = 36^2$

$36^{2x+4} = \sqrt{(36^2)^x}$

$36^{2x+4} = ((36)^{2x})^{\frac{1}{2}}$

$36^{2x+4} = 36^x$

$2x + 4 = x$

$\boxed{x = -4}$

$36^{2x+4} = \sqrt{1296^x}$

$36^{2x+4} = (\sqrt{1296})^x$

$36^{2x+4} = 36^x$

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Ex.2 Solve.

(a) $2^{x^2+2x} = \frac{1}{2}$

(b) $2^{2x} - 2^x = 12$

$2^{x^2+2x} = 2^{-1}$

$x^2 + 2x = -1$

$x^2 + 2x + 1 = 0$

$(x+1)^2 = 0$

$\boxed{x = -1}$

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Assigned Work:

Exercises: photocopied handout # 1, 3, 4, 7, 9d

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7. $\left(\frac{1}{9}\right)^{x+2} = \left(\frac{1}{27}\right)^{x+3}$

$\left(\frac{1}{3^2}\right)^{x+2} = \left(\frac{1}{3^3}\right)^{x+3}$

$\left(\left(\frac{1}{3}\right)^2\right)^{x+2} = \left(\left(\frac{1}{3}\right)^3\right)^{x+3}$

$\left(\frac{1}{3}\right)^{2x+4} = \left(\frac{1}{3}\right)^{3x+9}$

$(a^x)^3 = (a^x)(a^x)(a^x) = a^{3x}$

$\Rightarrow 2x+4 = 3x+9$

$-5 = x$

$\boxed{x = -5}$

(b) Verify $x = -5$

LS $= \left(\frac{1}{9}\right)^{x+2}$

$= \left(\frac{1}{9}\right)^{-5+2}$

$= \left(\frac{1}{9}\right)^{-3}$

$= 9^3$

$= 729$

RS $= \left(\frac{1}{27}\right)^{x+3}$

$= \left(\frac{1}{27}\right)^{-5+3}$

$= \left(\frac{1}{27}\right)^{-2}$

$= (27)^2$

$= 729$

$\because$ LS = RS

$\therefore x = -5$ is verified

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9(d) $2^{r^2+6r} = 2^{-8}$

$\Rightarrow r^2 + 6r = -8$

$r^2 + 6r + 8 = 0$

$(r+2)(r+4) = 0$

$r+2 = 0$ OR $r+4 = 0$

$\boxed{r = -2}$ $\boxed{r = -4}$

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