

## Solving Exponential Equations (part 2)

Ex.1 Solve.

Apr. 12/2011

(a)  $8^{x+4} = 2^6$

$$(2^3)^{x+4} = 2^6$$

$$2^{3x+12} = 2^6$$

$$\Rightarrow 3x+12=6$$

$$3x = -6$$

$$\boxed{x = -2}$$

(b)  $3(4^x) = 48$

$$\frac{3}{3} \frac{4^x}{3} = \frac{48}{3}$$

$$4^x = 16$$

$$4^x = 4^2$$

$$\Rightarrow \boxed{x = 2}$$

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(c)  $9^x = 27^{x+2}$

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

$$3^{2x} = 3^{3x+6}$$

$$\Rightarrow 2x = 3x+6$$

$$-6 = x$$

$$\boxed{x = -6}$$

(d)  $2^{x^2+5x} = \frac{1}{4^3}$

$$2^{x^2+5x} = \frac{1}{(2^2)^3}$$

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

$$2^{x^2+5x} = 2^{-6}$$

$$\Rightarrow x^2+5x = -6$$

$$x^2+5x+6 = 0$$

$$(x+2)(x+3) = 0$$

$$\boxed{x = -2} \text{ OR } \boxed{x = -3}$$

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Ex.2 Solve by guess and check.

(a)  $2^x = 9$

we know  $3^2 = 9$

$x > 2$

we know  $2^3 = 8$

$x > 3$

try:  $x = 3.2$

$2^{3.2} \doteq 9.18$

try:  $x = 3.1$

$2^{3.1} \doteq 8.57$

try:  $x = 3.18$

$2^{3.18} = 9.06$

$2^{3.17} = 9.00$

$x \doteq 3.17$

(b)  $3^{2x-5} = 25$

$3^3 = 27$

$3^{2.8} \doteq 21.6$

$3^{2.9} \doteq 24.19$

$3^{2.93} \doteq 25.001$

$\Rightarrow 2x - 5 \doteq 2.93$

$2x \doteq 7.93$

$x \doteq 3.965$

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Ex.3 Solve  $3^{x+2} - 3^x = 216$

$3^x \cdot 3^2 - 3^x = 216$

$3^x (3^2 - 1) = 216$

$3^x (9 - 1) = 216$

$3^x (8) = 216$

$3^x = 27$

$3^x = 3^3$

$\Rightarrow x = 3$

$3^{x+2}$   
 $= 3^x \cdot 3^2$

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Ex.4 Solve

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

$$\begin{aligned} 2^{2^x} &= (2^2)^x \\ &= 4^x \\ &= (2^x)^2 \end{aligned}$$

$$(2^x)^2 - 2^x = 12$$

let  $a = 2^x$

$$a^2 - a = 12$$

$$a^2 - a - 12 = 0$$

$$(a-4)(a+3) = 0$$

$a = 4$  or  $a = -3$

$$2^x = 4 \quad 2^x = -3$$

$$2^x = 2^2 \quad \text{inadmissible}$$

$$\boxed{x=2} \quad \text{DNE}$$

$$2^{2^x} - 2^x = 12$$

$$2^x \cdot 2^x - 2^x = 12$$

$$2^x (2^x - 1) = 12$$

(b)  $25^x - 30(5^x) + 125 = 0$

$$(5^2)^x - 30(5^x) + 125 = 0$$

$$(5^x)^2 - 30(5^x) + 125 = 0$$

let  $a = 5^x$

$$a^2 - 30a + 125 = 0$$

$$(a-5)(a-25) = 0$$

$a = 5$  or  $a = 25$

$$5^x = 5 \quad 5^x = 25$$

$$\boxed{x=1} \quad \boxed{x=2}$$

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**Exercises:**

(yesterday) photocopied handout # 1, 3, 4, 7, 9d

(today) handout # 5 (49)  
pg. 23 # (10, 11)(odd), 19, 20

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