

Exponential Equations

An exponential equation is an equation that contains a variable in the exponent.

To solve an exponential equation you need the base on each side to be the same.

Equality of powers with a common base

If $a^m = a^n$, then $m = n$ ($a > 0$, $a \neq 1$)

Solve

a) $2^x = 2^6$

$\therefore \boxed{x=6}$ ← equate the exponents

b) $3^m = 243$

$3^m = 3^5$ ← write 243 as a power with base 3
($3 \times 3 \times 3 \times 3 \times 3 = 243$)

$\therefore \boxed{m=5}$ ← equate the exponents

c) $2^{x-3} = 2^4$

$x-3=4$ ← equate the exponents

$x=4+3$ ← solve for x

$\therefore \boxed{x=7}$

d) $2^{2(x-5)} = 4^{3x-1}$

$2^{2(x-5)} = (2^2)^{3x-1}$ ← write 4 as 2^2

$2^{2(x-5)} = (2)^{2(3x-1)}$ ← simplify

$2(x-5) = 2(3x-1)$ ← equate the exponents

$2x-10 = 6x-2$ ← simplify and solve for x

$2x - 6x = -2 + 10$

$-4x = 8$

$\frac{-4x}{-4} = \frac{8}{-4}$

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

e) $6^{3x+1} = 36^x$... ⊗

$6^{3x+1} = (6^2)^x$ ← write 36 as a power with base 6

$6^{3x+1} = 6^{2x}$

$3x+1 = 2x$ ← equate the exponents and solve for x

$3x - 2x = -1$

$\therefore \boxed{x=-1}$

Proof: Sub. $x=-1$ into ⊗

L.S. = 6^{3x+1}

$= 6^{3(-1)+1}$

$= 6^{-3+1}$

$= 6^{-2}$

$= \frac{1}{6^2}$

$= \frac{1}{36}$

R.S. = 36^x

$= 36^{-1}$

$= \frac{1}{36^1}$

$= \frac{1}{36}$

$\therefore x=-1$ is the correct solution to ⊗ since L.S. = R.S.

Homework: Pg. 384: #1-5, 7e-h, 10