$$\log_2 (x+1) + \log_2 (x-1) = 3$$

$$\log_2 (x+1)(x-1) = 3$$

$$x^2 - 1 = 2^3$$

$$x^2 - 1 = 8$$

$$x^2 = 9 \qquad \text{or} \quad x^2 - 9 = 0$$

$$x = \cancel{\pm 3} \quad \overset{-3 \text{ is}}{\text{ext}} \quad (x-3)(x+3) = 0$$

$$x = 3 \qquad\qquad\qquad x = \pm 3$$

check: $x = 3$

$$\log_2 4 + \log_2 2 = 3$$
$$2 + 1 = 3 \quad \checkmark$$

extraneous $\boxed{x = -3}$

$$\log_2 \cancel{(-2)} + \log_2 \cancel{(-4)} = 3$$

$$\ln x - \ln(x-4) = \ln 3$$

$$\ln \left(\frac{x}{x-4} \right) = \ln 3$$

$$\frac{x}{x-4} = 3$$

$$x = 3x - 12$$

> if $\ln M = \ln N$
> then
> $M = N$

$$12 = 2x$$

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

check: $\ln 6 - \ln 2 = \ln 3$ ✓

$$\log_3 (1-x) + \log_3 (x+4) = \log_3 2 + \log_3 (1-2x)$$

$$\log_3 (1-x)(x+4) = \log_3 2(1-2x)$$

$$(1-x)(x+4) = 2(1-2x)$$

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

$$0 = x^2 - x - 2$$

$$= (x+1)(x-2)$$

$$x = -1, \cancel{2}$$

$$\{-1\}$$

check $x = -1$ ($x = 2$ is extraneous)

$$\log_3 2 + \log_3 3 = \log_3 2 + \log_3 3 \quad ✓$$

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brain teasers:

$$\log_3 (\log_4 x) = 0$$

$$\log_4 x = 3^0$$

$$\log_4 x = 1$$

$$x = 4^1 = 4$$