Solve: $3^{2x} - 5(3^x) + 4 = 0$ | u-Substitution

① Rewrite the equation in terms of u.
→ do not want x in the exponent

$u = 3^x$ $\quad u^2 = (3^x)^2 = 3^{2x}$

$u^2 - 5u + 4 = 0$

② Factor the polynomial in terms of u.

+(-5)	x(4)
-1, -4	-1, -4

$(u-1)(u-4) = 0$

③ Solve for u.

$u - 1 = 0$ $\quad u - 4 = 0$
$+1 \quad +1$ $\quad +4 \quad +4$

$u = 1$ $\quad u = 4$

These are NOT your answers!
Sub. back in ...

④ Sub $u = 1$ AND $u = 4$ into $u = 3^x$ to solve for x.

$u = 3^x$

$1 = 3^x$

$\log_3 1 = x$

$0 = x$

Solve by rolling out.

$4 = 3^x$

$\log_3 4 = x$

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

$1.262 = x$

Solve: $2^x + 8(2)^{-x} = 9$

① Rewrite so that the $-x$ is not there.

$$2^x + \frac{8}{2^x} = 9$$

② Get 2^x out of the denominator by multiplying EVERYTHING by 2^x.

$$2^x\left(2^x + \frac{8}{2^x} = 9\right)$$

Simplify.

$$2^{2x} + 8 = 9(2^x)$$

$$-9(2^x) \quad \text{Reorder.} \quad -9(2^x)$$

$$2^{2x} - 9(2^x) + 8 = 0$$

③ NOW find u, rewrite, solve, & sub/solve.

$u = 2^x \qquad u^2 = (2^x)^2 = 2^{2x}$

$$u^2 - 9u + 8 = 0$$

$$(u-8)(u-1) = 0 \quad \text{Factor.}$$

$u - 8 = 0 \qquad u - 1 = 0$

$+8 \quad +8 \qquad +1 \quad +1$

$u = 8 \qquad u = 1 \quad$ Solve.

$u = 2^x$

$8 = 2^x$

$\log_2 8 = x$

$\frac{\log 8}{\log 2} = \boxed{3 = x}$

$u = 2^x$

$1 = 2^x$ Sub & Roll out.

$\log_2 1 = x$

$\boxed{0 = x}$

Solve: $x^{2/3} + 3x^{1/3} + 2 = 0$

Pick a u that takes care of the fraction.

$u = x^{1/3}$ $\quad u^2 = (x^{1/3})^2 = x^{2/3}$

Rewrite.

$u^2 + 3u + 2 = 0$

$(u+1)(u+2) = 0$

$u+1=0 \quad u+2=0$

$-1 \ -1 \quad -2 \ -2$

$u = -1 \quad u = -2$

$u = x^{1/3}$

$-1 = x^{1/3} \quad -2 = x^{1/3}$

Need to make the xs have a power of 1, so cube both sides.

$(-1)^3 = (x^{1/3})^3 \quad (-2)^3 = (x^{1/3})^3$

$\boxed{-1 = x}$ $\quad \boxed{-8 = x}$

Solve: $3^{2x} + 3^{2+x} - 10 = 0$

Split up 3^{2+x} using exponent rules.

$3^{2x} + 3^2 \cdot 3^x - 10 = 0$

$3^{2x} + 9(3^x) - 10 = 0$

Now we can pick a u.

$u = 3^x$ $\quad u^2 = (3^x)^2 = 3^{2x}$

$u^2 + 9u - 10 = 0$

$(u+10)(u-1) = 0$

$u+10=0$ $\quad u-1=0$

$-10\ -10$ $\quad +1\ +1$

$u = -10$ $\quad u = 1$

$u = 3^x$

$-10 = 3^x$ $\quad 1 = 3^x$

$\log_3(-10) = x$ $\quad \log_3 1 = x$

unreal answer $\quad 0 = x$