# Review Exercise Set 10

Exercise 1: Solve the exponential expression exactly for x.

$$4^x = 256$$

Exercise 2: Use a calculator to solve the exponential expression for x. Round your answer to three decimal places.

$$e^{2x} + 2e^x - 15 = 0$$

Exercise 3: Find the exact value of x in the logarithmic equation. Do not round off the answer.

$$\log (x - 1) + \log (x + 6) = \log (4x)$$

Exercise 4: Use a calculator to solve the exponential expression for x. Round your answer to three decimal places.

$$\ln (1 - x) - \ln (2x + 3) = \ln (x)$$

Exercise 5: If you were to deposit \$5,000 into an account paying 6% interest compounded quarterly, how many years would it take until you had \$30,000 in the account?

# Review Exercise Set 10 Answer Key

Exercise 1: Solve the exponential expression exactly for x.

$4^x = 256$

$4^x = 4^4$

**$x = 4$**

Exercise 2: Use a calculator to solve the exponential expression for x. Round your answer to three decimal places.

$e^{2x} + 2e^x - 15 = 0$

To make the problem look easier, let $w = e^x$ which would make $e^{2x} = w^2$

$w^2 + 2w - 15 = 0$

Factor the quadratic equation

$(w + 5)(w - 3) = 0$

Set each factor equal to zero

$w + 5 = 0$ or $w - 3 = 0$

Replace w with $e^x$ and solve each equation for x

$e^x + 5 = 0$ or $e^x - 3 = 0$

$e^x + 5 = 0$
$e^x = -5$
$\ln e^x = \ln (-5)$
$x = \ln (-5)$

ln (-5) is not a real number so there is no solution for this equation

$e^x - 3 = 0$
$e^x = 3$
$\ln e^x = \ln 3$
$x = \ln 3$
**$x \approx 1.099$**

Exercise 3: Find the exact value of x in the logarithmic equation. Do not round off the answer.

$$\log(x - 1) + \log(x + 6) = \log(4x)$$

Combine the logs on the left side of the equation

$$\log(x - 1)(x + 6) = \log(4x)$$

Use the properties of logs to remove the logs from both sides

$$(x - 1)(x + 6) = 4x$$

FOIL the left side

$$x^2 + 5x - 6 = 4x$$

Gather all terms on the left side

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

Factor and solve for x

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

$x + 3 = 0$
$x = -3$

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

Test each value to determine if it is a valid solution

$\log(x - 1) + \log(x + 6) = \log(4x)$
$\log(-3 - 1) + \log(-3 + 6) = \log(4)(-3)$
$\log(-4) + \log(3) = \log(-12)$

$x = -3$ is not a valid solution since it would cause us to be taking the log of a negative number.

$\log(x - 1) + \log(x + 6) = \log(4x)$
$\log(2 - 1) + \log(2 + 6) = \log(4)(2)$
$\log(1) + \log(8) = \log(8)$
$\log(1 * 8) = \log(8)$
$\log(8) = \log(8)$

**x = 2 would be the solution for this logarithmic equation.**

Exercise 4: Use a calculator to solve the exponential expression for x. Round your answer to three decimal places.

ln (1 - x) - ln (2x + 3) = ln (x)
ln (1 - x) = ln (x) + ln (2x + 3)
ln (1 - x) = ln (x)(2x + 3)
1 - x = (x)(2x + 3)
1 - x = $2x^2$ + 3x
0 = $2x^2$ + 4x - 1

The quadratic equation will not factor so we must use the quadratic formula.

a = 2; b = 4; c = -1

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(4) \pm \sqrt{(4)^2 - 4(2)(-1)}}{2(2)} \\ &= \frac{-4 \pm \sqrt{16+8}}{4} \\ &= \frac{-4 \pm \sqrt{24}}{4} \\ &= \frac{-4 \pm 2\sqrt{6}}{4} \\ &= \frac{-2 \pm \sqrt{6}}{2} \end{aligned}$$

$$x = \frac{-2+\sqrt{6}}{2} \quad or \quad x = \frac{-2-\sqrt{6}}{2}$$
$$x \approx 0.225 \qquad\qquad x \approx -2.225$$

**The variable x cannot be a negative number since it would cause us to have the natural log of a negative number which is not possible. Therefore, the solution for the equation is that x is approximately equal to 0.225.**

Exercise 5: If you were to deposit \$5,000 into an account paying 6% interest compounded quarterly, how many years would it take until you had \$30,000 in the account?

Identify the given information

$P = 5000$
$r = 6\% = 0.06$
$n = 4$ (quarterly)
$A = 30000$

Substitute the known values into the compound interest formula and solve for the unknown variable.

$$A = P(1 + r/n)^{nt}$$
$$30000 = 5000(1 + 0.06/4)^{4t}$$
$$30000 = 5000(1 + 0.015)^{4t}$$
$$30000 = 5000(1.015)^{4t}$$
$$6 = (1.015)^{4t}$$
$$\log 6 = \log (1.015)^{4t}$$
$$\log 6 = 4t * \log 1.015$$
$$\frac{\log 6}{4\log 1.015} = t$$
$$30.086 \approx t$$

**It would take approximately 30 years for the account balance to reach \$30,000.**