

NAME:

Problem 1 (3 points):*Solve the following equation for x .*

$$\log_3(\ln x) = 1$$

Solution:

Let $u = \ln x$. Then we can use the fact that if $\log_3 u = 1$ then $u = 3$ to conclude that

$$\ln x = 3$$

We can then use the definition of logarithm or take e to both sides to conclude that

$$x = e^3$$

Problem 2 (3 points): *Suppose you invest \$300 in an account earning 5% interest compounded quarterly. How much will the account be worth in 3 years? Give an exact answer, not a decimal approximation. You do not need to simplify your answer.*

Solution:

The formula for compound interest is

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

In our case, $P = 300$, $r = 0.05$, $t = 3$, $n = 4$ and so we get that

$$A = 300 \left(1 + \frac{0.05}{4}\right)^3$$

Problem 2 (3 points): Solve the following equation for x . Be sure to check your answers.

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

Solution: We first note that since $3^1 = 3$ we have that $1 = \log_3 3$ and so our equation can be rewritten as

$$\log_3 x + \log_3(x - 2) = \log_3 3$$

Using logarithm properties we have that $\log_3 x + \log_3(x - 2) = \log_3 x(x - 2) = \log_3(x^2 - 2x)$ and so our equation can be rewritten as

$$\log_3(x^2 - 2x) = \log_3 3$$

Therefore, we must have that

$$\begin{aligned}x^2 - 2x &= 3 \\x^2 - 2x - 3 &= 0 \\(x - 3)(x + 1) &= 0\end{aligned}$$

This has solutions of $x = -1$ and $x = 3$

However, we also need to be sure that $\log_3 x$ and $\log_3(x - 2)$ are defined. From this we obtain the conditions $x > 0$ and $x - 2 > 0$. From the second one we get as a requirement $x > 2$ and therefore we conclude that the only solution is

$$x = 3$$

Problem 4 (1 point): Saying that $(x - 1)^2$ is equal to $x^2 - 1$ is (circle one:)

CORRECT

A VITAL ERROR

Solution: The above operation is a **VITAL ERROR**. We instead have that

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