Bellwork

Solve for x:

\[ 2^x = 7 \]

Key Idea: when the exponent is a variable, take the log of each side.

\[ \log_2 x = \log_7 \]

Reflection: Easy once we set \[ \log_2 7 = x \] (up)

Example 4: Compound Interest

Suppose you deposit $1,000 into a savings account that earns 5% interest compounded annually.

\[ A = \text{?} \quad P = \text{1000} \quad n = \text{1} \quad r = \text{0.05} \quad t = \text{5} \]

How much will you have after 5 years if you do not deposit or withdraw any money?

\[ A = 1000 \left(1 + \frac{0.05}{1}\right)^{5}\]

\[ A = 1276.28 \]

Example 4: Compound Interest

How much will you have over the same time period if interest is compounded monthly?

\[ A = 1000 \left(1 + \frac{0.05}{12}\right)^{12 \times 5} \]

\[ A = 1283.35 \]

How much will you have over the same time period if interest is compounded quarterly?

\[ A = 1000 \left(1 + \frac{0.05}{4}\right)^{4 \times 5} \]

\[ A = 1282.03 \]

Example 4: Compound Interest

How long will it take for our money to double when compounded annually?

Example 5

If you deposit $2,000 in an account with 5% interest compounded annually, how much will your deposit be worth after 5 years?

\[ A = \text{?} \quad P = \text{2000} \quad n = \text{?} \quad r = \text{?} \quad t = \text{5} \]
Example 5

If you deposit $2,000 in an account with 5% interest compounded annually, how much will your deposit be worth after 5 years?

\[ A = \ldots \quad P = \ldots \quad n = \ldots \]

\[ r = \ldots \quad t = \ldots \]

Continuously Compounding Interest

Some interest is compounded continuously. The formula for this is:

\[ A = P e^{rt} \]

Example 6

How much will I have after three years if I place $5,000 into an account with a continuously compounding interest of 4%?

\[ A = Pe^{rt} \quad P = 5000 \quad r = 0.04 \quad t = 3 \]

\[ A = 5000e^{0.04 \times 3} = 5000e^{0.12} \]

What if the same account accrues 4% interest semi-annually?

\[ A = 10000 \]

\[ \ln 2 = 0.04t \quad t = \frac{\ln 2}{0.04} \approx 17.3 \text{ years} \]

I want to have $10,000 in my savings account before I retire. I am going to deposit $2,000 now in an account that accrues interest continuously at 3%. Is this a good plan for me? Why or why not?

Identify the following as exponential growth or decay

\[ 2(3)^x \quad \text{growth} \quad >1 \]

\[ \left(\frac{1}{2}\right)^x \quad \text{decay} \quad <0<1 \]
Identify the domain and range

\[ y = 2 \left( \frac{1}{3} \right)^x + 4 \]

Domain: all real numbers \( \mathbb{R} \)

Range: \( y > 4 \) and \( y \rightarrow -\infty \) as \( x \rightarrow \infty \)

Graph the following growth or decay function

\[ y = 2 \cdot \left( \frac{1}{2} \right)^{x-1} + 1 \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>9</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Asymptote: \( y = 1 \)

Re-write in exponential form

\[ \log_3 \frac{1}{27} = 3 \]

\[ \log_6 6 = 1 \]

\( 6^1 = 6 \)

Re-write in logarithmic form

\[ 8^2 = 64 \]

\[ \log_8 64 = 2 \]

Evaluate the logarithm

\[ \log_5 25 \]

\[ \ln 7 \]

\[ \log_2 16 \]

\[ \frac{\log_2 16}{\log_2 2} = x \]

\[ 2^x = 16 \]

\[ x = 4 \]

Evaluate the following using change of base

\[ \log_2 9 \]

\[ \frac{\log_9 9}{\log_9 2} = 3 \cdot 10 \]
Condense the following into a single logarithm:

\[ \log \frac{x^3}{x} = \log x^2 \]

\[ \ln \frac{1}{2} x^2 \]

Expand each logarithm:

\[ \log_2\frac{x}{3} \]

\[ \ln \frac{2x^2}{3} \]

\[ 2\ln x - 3\ln y \]

\[ \ln 2 + \ln a - 3\ln b \]

Solve each equation. Round to the nearest ten-thousandth.

\[ 4^x = 64 \]

\[ 3^{x+1} = 3^3 \]

\[ x = 3 \]

\[ \log_2 x = 3 \]

A new car that sells for $20,000 depreciates at a rate of 20%.

a) Write a model to represent that value of the car after \( t \) years.

b) Evaluate the model to find the value of the car after the first 3 years.

log \_b (x + 5) - log \_b 3 = log \_b 10
Robert invested $1000 in a bank account. The account has an annual interest rate of 4.5%. How much money will be in the account after 14 years?

Suppose you deposit $5000 in a savings account that pays interest at an annual rate of 4% compounded continuously. How many years will it take for the balance in your savings account to reach $10,000? Round your answer to the nearest tenth.

Summary

What part of the test are you most prepared for?

What part do you need to study for?