Name _____ Date _____

1. Your grandparents deposited $2000 into a college savings account for you 5 years ago. If the account pays 2.5% annual interest, compounded quarterly, find the current balance of the savings account.

2. You buy a computer for $1200. The value of the computer decreases by 30% each year. Find the value of the computer after 4 years.

3. On your birthday you receive a PDA for $300. The value of the PDA decreases by 20% each year. What will its value be 4 years from now?

4. You deposit $300 into a savings account that pays 5% annual interest. If the account compounds daily, how long will it take for the account to reach $600, to the nearest year?

5. In 2 years, you want to have $5000 in your savings account. Find the amount you should deposit if the account pays 3% annual interest, compounded monthly.

6. A new motorboat costs $6000. The value of the boat decreases by 15% each year. What is the value of the boat after 3 years?

Simplify the expression.

7. $e^2 \cdot e^5$

8. $(2e^{-2x})^{-1}$

9. $\sqrt{16e^{10}}$

10. $(e^{0.25x})^8$

11. $2e^{-x} \cdot e^{3x} \cdot e^{-2x}$

12. $10^{\log 5x}$

13. $\log_2 (0.25)^x$

14. $\log_4 256^{2x}$

15. $\log_4 16^x$

Evaluate the logarithm without using a calculator.

16. $\log_5 25$

17. $\log_{1/3} 81$

18. $\log_2 8$

19. $\log_5 5$

20. $\log_6 1$

21. $\log_{1/3} 27$

Expand the expression.

22. $\ln 4y^2$

23. $\log_4 16x^8y^6$

24. $\ln 16x^2$

25. $\log_5 \frac{2x^3}{4y}$

Condense the expression.

26. $\log_6 2 + \log_6 18$

27. $\ln xy + \ln xy^2 - \ln x^2y$

28. $\log_3 2x + 3 \log_3 4x$

29. $\ln 72x - 2 \ln 2y$

Use the change-of-base formula to evaluate the logarithm.

30. $\log_4 12$

31. $\log_9 18$

Quiz Review

Growth / Decay Formulas * write % as a decimal → 3% → r = 0.03

Growth. (increases - keyword)

$y = a(1+r)^t$

Decay (decreases - keyword)

$y = a(1-r)^t$

Compounded monthly, quarterly, etc. → countable number of times

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

n = # of times per year

Compounded continuously

$A = Pe^{rt}$

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1. $A = P\left(1+\frac{r}{n}\right)^{nt}$ $P = 2000$, $r = 0.025$, $n = 4$, $t = 5$

$A = 2000\left(1+\frac{0.025}{4}\right)^{4.5}$

$= 2000(1.00625)^{20}$

$\approx 2000(0.9687779604)$

≈ 1937.56

$1937.56

2. decreases → $y = a(1-r)^t$

$a = 1200$

$r = 0.30$

$t = 4$

$y = 1200(1-0.30)^4$

$y = 1200(0.70)^4$

$y = 1200(0.2401)$

$y = \$288.12$

3. decreases $\longrightarrow$ $y = a(1-r)^t$

$a = 300$

$r = 0.20$

$t = 4$

$y = 300(1-0.20)^4$

$y = 300(.80)^4$

$y = 300(0.4096)$

$\boxed{y = \$122.88}$

4. This would be a BONUS question, since we didn't do any like this in class.

compounds <u>daily</u> $\longrightarrow$ $A = P\left(1+\frac{r}{n}\right)^{nt}$

$P = 300$

$r = 0.05$

$n = 365$ (daily $\rightarrow$ 365 days)

$A = 600$

$t =$ variable we are finding

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

$\frac{600}{300} = \frac{300\left(1+\frac{0.05}{365}\right)^{365t}}{300}$

$2 = \left(1+\frac{0.05}{365}\right)^{365t}$

$2 = (1.00013698630\ldots)^{365t}$

$2 = 1.0512674960\ldots^{t}$

Rewrite as a logarithm

$\log_{1.0512674960} 2 = t$

$\frac{\log 2}{\log 1.0512674960} = t$

$\approx t$

5. Compounded monthly → $A = P\left(1+\frac{r}{n}\right)^{nt}$

$A = 5000$
$t = 2$
$r = 0.03$
$n = 12$ (monthly = 12 times per year)

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

$5000 = P\left(1+\frac{0.03}{12}\right)^{12\cdot 2}$

$\frac{5000}{(1+0.0025)^{24}} = \frac{P(1+0.0025)^{24}}{(1+0.0025)^{24}}$

$P = \frac{5000}{(1.0025)^{24}} = \frac{5000}{1.061757044\ldots} \approx \boxed{\$4709.18}$

6. decreases → $y = a(1-r)^t$

$a = 6{,}000$
$r = 0.15$
$t = 3$

$y = 6{,}000(1-0.15)^3$
$y = 6{,}000(0.85)^3$
$y = 6{,}000(0.614125)$
$\boxed{y = \$3{,}684.75}$

Example of compounded continuously.

If $4,000 is deposited into an account that pays 4% annual interest compounded continuously, how much money would be in the account after 20 years?

continuously → $A = Pe^{rt}$

$P = 4000$
$r = 0.04$
$t = 20$

$A = 4000\,e^{0.04\cdot 20}$
$A = 4{,}000\,e^{0.8}$
$A = 4{,}000(2.225540928)$
$\boxed{A = \$8902.16}$

Example of changing exponential / logarithmic equations.

$$b^x = y \iff \log_b y = x$$

Ex: $\log_5 125 = 3 \iff 5^3 = 125$

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7. $e^2 \cdot e^5 = e^7$

8. $(2e^{-2x})^{-1} = (2)^{-1}(e^{-2x})^{-1} = \frac{1}{2}e^{2x}$ or $\frac{e^{2x}}{2}$

9. $\sqrt{16e^{10}} = 4e^5$

10. $(e^{0.25x})^8 = e^{2x}$

11. $2e^{-x} \cdot e^{3x} \cdot e^{-2x} = 2e^{-x+3x-2x} = 2e^0 = 2 \cdot 1 = 2$

12. $10^{\log 5x} = 5x$

13. $\log_2 (0.25)^x = \log_2 \left(\frac{1}{4}\right)^x = \log_2 \left(\frac{1}{2^2}\right)^x = \log_2 (2^{-2})^x$
$= \log_2 2^{-2x} = -2x$

14. $\log_4 256^{2x} = \log_4 (4^4)^{2x} = \log_4 4^{8x} = 8x$

15. $\log_4 16^x = \log_4 (4^2)^x = \log_4 4^{2x} = 2x$

16. $\log_5 25 = 2 \quad (5^2 = 25)$

17. $\log_{\frac{1}{3}} 81 = -4 \quad \left(\left(\frac{1}{3}\right)^{-4} = 3^4 = 81\right)$

18. $\log_2 8 = 3 \quad (2^3 = 8)$

19. $\log_5 5 = 1 \quad (5^1 = 5)$

20. $\log_6 1 = 0 \quad (6^0 = 1)$

21. $\log_{\frac{1}{3}} 27 = -3 \quad \left(\left(\frac{1}{3}\right)^{-3} = 27\right)$

22. $\ln 4y^2 = \ln 4 + \ln y^2 = \ln 4 + 2\ln y$

23. $\log_4 16x^8y^6 = \log_4 16 + \log_4 x^8 + \log_4 y^6$

$= 2 + 8\log_4 x + 6\log_4 y$

24. $\ln 16x^2 = \ln 16 + \ln x^2 = \ln 16 + 2\ln x$

25. $\log_5 \frac{2x^3}{4y} = \log_5 2x^3 - \log_5 4y$

$= \log_5 2 + \log_5 x^3 - (\log_5 4 + \log_5 y)$

$= \log_5 2 + 3\log_5 x - \log_5 4 - \log_5 y$

26. $\log_6 2 + \log_6 18 = \log_6 2 \cdot 18 = \log_6 36 = 2$

27. $\ln xy + \ln xy^2 - \ln x^2y = \ln \frac{xy(xy^2)}{x^2y}$

$= \ln y^2$

28. $\log_3 2x + 3\log_3 4x$

$= \log_3 2x + \log_3 (4x)^3 = \log_3 2x(4x)^3$

$= \log_3 2x \cdot 64x^3 = \log_3 128x^4$

29. $\ln 72x - 2\ln 2y = \ln 72x - \ln (2y)^2$

$= \ln 72x - \ln 4y^2 = \ln \frac{72x}{4y^2}$

30. $\log_4 12 = \frac{\log 12}{\log 4} \approx 1.792$ or $\frac{\ln 12}{\ln 4}$

31. $\log_9 18 = \frac{\log 18}{\log 9} \approx 1.315$ or $\frac{\ln 18}{\ln 9}$