Key

Unit 2 Test Prep

Exponential Functions

1. Use the table below to answer the following questions.

x	f(x)
0	128
1	64
2	32
3	16

What is the common ratio?

.5

What is the initial value?

128

f(x) = $128 \cdot 0.5^x$

2. A local gym initially has 250 members. The number of members grows by 5% each year through new sign-ups.

Write an equation, M(t), that represents the number of members after t years.

$M(t) = 250 \cdot 1.05^t$

How many members will the gym have after 8 years?

≈ 369 members

How long will it take for the gym to have 500 members?

14.2 years

3. The population of a small town is 8,000 people and is increasing at an annual rate

Write an equation, P(t), that represents the population after t years.

$P(t) = 8000(1.035)^t$

What will the population be in 10 years?

11285

How long will it take for the population to reach 15,000 people?

18.27 years

4. Find the equation of the exponential curve that passes through the points (0,3) and (2,75).

$y = 3(5^x)$

5. Rewrite the following exponential equations as a logarithmic equation:

$5^3 = 125$

$\log_5 125 = 3$

$32^x = 164$

$\log_{32} 164 = x$

$4^3 = 64$

$\log_4 64 = 3$

6. Rewrite the following exponential equation as a natural logarithmic equation: $e^x = 9$

$\ln 9 = x$

7. Rewrite ln(7) = y as an exponential equation.

$e^y = 7$

8. Rewrite $4e^{2x} = 20$ as a natural logarithmic equation.

$\ln 5 = 2x$

9. A new online game is gaining players, with its user base growing by 15% every month. On September 1st, the game had 200,000 active players.

Find the function that predicts the number of active players, t months after September 1st.

$P(t) = 200000(1.15)^t$

Based on this trend, what is the estimated number of active players on January 1st of the following year? 4 months

349,801

10. John takes out a personal loan for $8,000 at a simple interest rate of 6% per year. He plans to repay the loan in 5 years. How much will he pay in interest by the end of the loan period?

$2400

11. Sarah invests $2,500 in a savings account that earns 4% simple interest per year. How much interest will she earn after 3 years? What will the final amount in her account be?

$300 interest

$2800 final amount

12. A loan of $500 has a simple interest rate of 11% annually. If the total interest paid is $55, what was the duration of the loan in years?

1 year

13. A 180-day short-term investment note (T-Bill) has a maturity value of $2,000. If you purchase the note for $1,970.50, what annual simple interest rate will you earn? Use a 360-day year.

2.994%

14. A 45-day commercial paper is sold for $9,885.50. If its maturity value is $10,000, what i the annual simple interest rate earned? Use a 360-day year.

9.25%

15. A small business owner purchases a 270-day bank note with a face value of $15,000 for $14,600. What is the annual simple discount rate for this transaction? Use a 360-day year.

$d = \frac{\text{discount}}{\text{facevalue(time)}}$ 3.56%

don't do

16. If you deposit $5,000 into a savings account that pays 4% interest compounded annually, how much money is in the account after 7 years?

$6579.[illegible]
↑
.66

17. You want to have $18,000 in your savings account in 8 years. If your account earns 4.5% interest compounded annually, how much money do you need to deposit today?

$12,657.33

18. A savings account with an initial deposit of $5,000 grows to $7,500 in 6 years. Assuming annual compounding, what is the annual interest rate?

6.99%

19. After 5 years, your investment of an unknown principal has grown to $25,000. The account earns 6% interest per year, compounded quarterly. What was your original principal investment?

$18,561.76

20. Suppose that $7,500 is invested in a savings account at an annual rate of 3.5% compounded continuously for 8 years. What is the final amount?

$9923.47

21. Find the APY for each of the given money market accounts. Which offers a higher yield?

Pioneer Bank: 5.15% compounded daily

5.28%

* **Mountain Credit Union:** 5.25% compounded monthly

5.38%

State Trust: 5.05% compounded weekly

5.18%

22. David starts saving for his retirement at age 25. He opens an account that offers an annual interest rate of 4.8%, compounded monthly. He contributes $300 a month to the account. What will be the total value of his account after 15 years?

$78861.36

Part 2

After 15 years, David decides to increase his retirement savings. He moves his accumulated funds into a new investment that earns an annual interest rate of 5.5%, compounded monthly. He also increases his monthly contribution to $500. How much will he have in the account after an additional 10 years?

$216,268.83

23. A company is saving for a future expansion. It deposits $12,000 at the end of each quar into an account that earns 5.2% interest, compounded quarterly. How much will be in the account after 10 years?

$624,369.81

24. A small town takes out a loan of $500,000 to build a new community center. The loan requires them to set up a sinking fund to pay off the principal in 15 years. If the fund earns 4% interest, compounded annually, what is the payment the town should make at the end of each year?

$44,970.55

25. A family is saving up for their child's college education. They want to have $100,000 available in 18 years. If they can deposit $250 a month into a sinking fund, what annual interest rate must the fund earn, with monthly compounding, in order to guarantee that the fund will be worth $100,000 in 18 years?

6.31%

26. A person takes out a car loan for $20,000 at an annual interest rate of 4.8%, compounded monthly. The loan is for a term of 5 years. What is the amount of the monthly payment?

$375.59

27. A family takes out a 30-year mortgage for $300,000 at an annual interest rate of 4.5%, compounded monthly.

What is the monthly mortgage payment?

$1520.06

~~What will the remaining loan balance be after the first 5 years of payments?~~

$273,479.48 ← may not

28. A person saves for retirement by depositing $500 at the beginning of each month into an account that earns 6% annual interest, compounded monthly. What will the total value of the account be after 30 years?

$504,768.81

29. You are considering a lease on a new piece of equipment that requires payments of $2,500 at the beginning of each month for 4 years. The interest rate is 5.4% per year, compounded monthly. What is the present value of this lease?

$108,192.57

30. A savings plan offers a rate of 4% compounded annually.

What is the future value of a $1,000 deposit made at the **end** of each year for 10 years?

$12006.11

What is the future value of a $1,000 deposit made at the **beginning** of each year for 10 years?

$12,486.35

31. A small business takes out a loan for $25,000 at an annual interest rate of 4.8%, compounded monthly. The loan term is 1 year. Create a full amortization table for this loan, showing the following for each monthly payment:

Payment Number	Amount of Payment	Interest Per Period	Portion to Principal	Balance
0	~~2137.90~~		0	25000
1	2137.90	100	2037.9	22962.1
2		91.85	2046.05	20916.06
3		83.66	2054.24	18861.82
4		75.45	2062.45	16,799.37
5		67.20	2070.70	14728.67
6		58.91	2078.98	12649.69
7		50.60	2087.3	10562.39
8		42.25	2095.65	8466.74
9		33.87	2104.03	6362.72
10		25.45	2112.45	4250.27
11		17.00	2120.90	2129.37
12		8.52	2129.38	$0