

Math 30-2 Exponential Functions Lesson 5 Practice Questions[Solutions at end]

Use the following information to answer the first question.

Peter invested \$5000 into a GIC where interest was compounded yearly. With his Math 30-2 background he was able to write out the equation to model his investment:

$$A = 5000(1.032)^4$$

1. Which of the following statements is correct?
  - A) His investment is for a 5 year term.
  - B) The interest rate is 32%.
  - C) Over the term of the investment, the total interest earned will be \$671.38.
  - D) The future value of his investment will be \$5471.38.
2. Suppose you wish to determine the length of time for a \$12 725 investment to grow to *at least* \$15 000, if it is compounded monthly at an annual rate of 2.5%. The compound formula is:

Future amount = Original amount  $\left(1 + \frac{0.25}{12}\right)^n$ , where n is the number of months. To the nearest tenth of a year, the time for the investment to reach *at least* \$15 000 is \_\_\_\_\_.

3. Aaron invested \$4000 for 3 years into an account that pays 2%/a compounded annually. Which of the following functions models the value, V, of Aaron's investment in 3 years time?
  - A)  $V = 4000(0.02)(3)$
  - B)  $V = 4000(0.02)^3$
  - C)  $V = 4000(1.02)(3)$
  - D)  $V = 4000(1.02)^3$

Use the following information to answer the next question.

Rhonda invested an amount of money in a GIC paying 1.75%/a, compounded annually for 5 years. The total amount of the investment at the end of the 5 year term was \$20 176.41.

4. The amount of the initial investment can be written in the form  $KM N00$ , where K, M, and N are integers. The values for K, M, and N are, respectively, \_\_\_\_, \_\_\_\_, and \_\_\_\_.

Use the following information to answer the next question.

Suppose you purchase a new car for \$38 400. It depreciates by 22% for the first year, and then depreciates by a different rate for the next 5 years. The table below shows the depreciation.

Year	Value
2	29 952
3	25 159.68
4	21 134.13
5	17 752.67
6	14 912.24

5. The depreciation rate for years 2 through 6 is  
A) 20%                      B) 18%                      C) 15%                      D) 12%

Use the following information to answer the next question.

Clorinda has decided to accept her company's buy-out package of \$100 000. On her last day of work, she meets with her bank manager to get financial advice. She wants to know if she should invest the money into an account that earns 4.5%/a compounded monthly.

6. A) If Clorinda invests the money, how much will she have in her account

after 5 years? [Use  $A = P\left(1 + \frac{0.045}{12}\right)^n$  ]

B) Determine how many months it will take Clorinda to pay off the rest of her mortgage if she applies the buy-out money towards her mortgage.

Use the equation:  $(1.003\ 305\ 890)^{-n} = 0.669\ 411$ , where n represents the number of months.

Use the following information to answer the next question.

Two brothers borrowed \$12 800 from their parents to buy some new recording equipment for their musical studio. Their parents charged an interest rate of 1.5%, compounded annually. When the loan was paid off, the interest accrued was \$584.68.

7. The length of the loan, to the nearest year, was \_\_\_\_ years.

8. If \$57 000 grows to \$61 698.63 after 4 years of annual compound interest, what is the interest rate?

Use the following information to answer the next question.

Sandy's father deposited \$1500 into an account for her when she was born. He was able to invest this money at 5% compounded annually.

9. A) How long will it take for the money to double?

B) How much money will Sandy have on her 20<sup>th</sup> birthday?

C) Suppose on her 20<sup>th</sup> birthday she wants to reinvest her accumulated amount but the interest rate is only half of the rate compared to the day she was born. Write an equation to model this scenario.

Math 30-2 Exponential Functions Lesson 5 Practice Questions **Solutions**

Use the following information to answer the first question.

Peter invested \$5000 into a GIC where interest was compounded yearly. With his Math 30-2 background he was able to write out the equation to model his investment:

$$A = 5000(1.032)^4$$

1. Which of the following statements is correct?
  - A) His investment is for a 5 year term.
  - B) The interest rate is 32%.
  - C) Over the term of the investment, the total interest earned will be \$671.38.
  - D) The future value of his investment will be \$5471.38.

**Solution**

Option A is false. The investment is for a 4 year term. Since interest is compounded yearly, the value of the exponent, 4, represents the total number of years for the investment.

Option B is false. To determine the percent, take the number in brackets i.e. (1.032) and move the decimal two places to the right. The interest rate is 3.2%.

Option C is true. To determine the interest earned, the future value is determined.

$$\text{Future value} = 5000(1.032)^4$$

$$\text{Future value} = \$5671.38$$

Subtract the initial \$5000 investment from this number, and the difference is the interest earned.

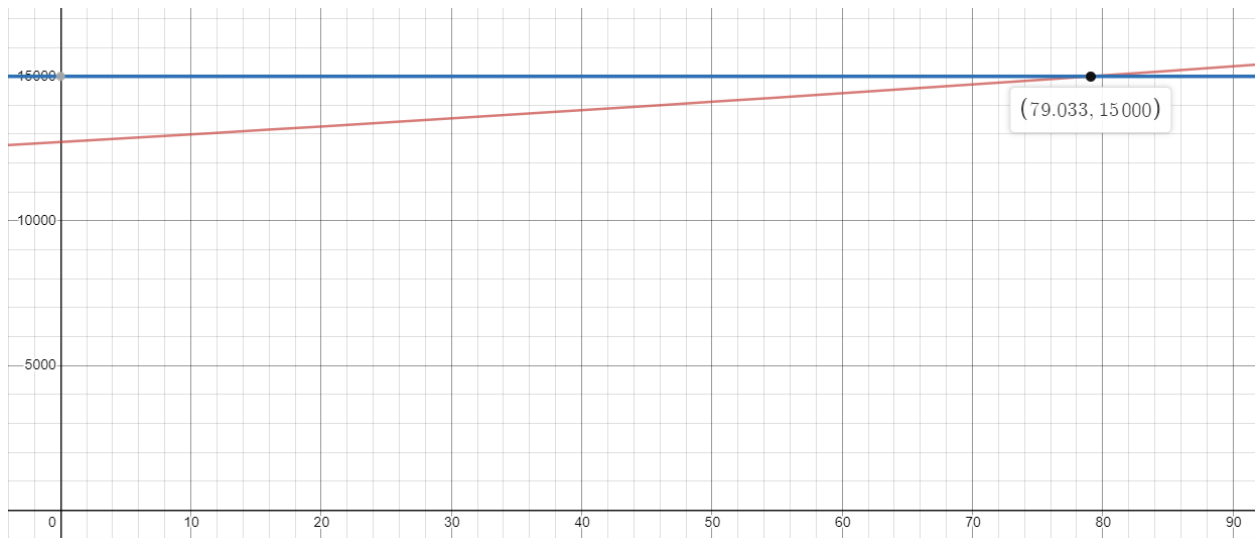
Option D is false. The future value is not \$5471.38, but \$5671.38.

2. Suppose you wish to determine the length of time for a \$12 725 investment to grow to *at least* \$15 000, if it is compounded monthly at an annual rate of 2.5%. The compound formula is:

Future amount = Original amount  $\left(1 + \frac{0.25}{12}\right)^n$ , where n is the number of

months. To the nearest tenth of a year, the time for the investment to reach *at least* \$15 000 is 6.6.

### Solution



Graph  $y_1 = 15000$  and  $y_2 = 12725\left(1 + \frac{0.25}{12}\right)^n$

The x-coordinate of the intersection point is 79.033. This value represents the number of months. Divide this number by 12 to convert it to years.

$$\frac{79.033}{12} = 6.586$$

To the nearest tenth of a year, the time for the investment to reach *at least* \$15 000 is 6.6.

3. Aaron invested \$4000 for 3 years into an account that pays 2%/a compounded annually. Which of the following functions models the value,  $V$ , of Aaron's investment in 3 years time?

A)  $V = 4000(0.02)(3)$

B)  $V = 4000(0.02)^3$

C)  $V = 4000(1.02)(3)$

D)  $V = 4000(1.02)^3$

### Solution

Compound interest is an example of exponential growth. Therefore, an exponent is required. Options A and C are both multiplied by 3, rather than the rate being raised to an exponent of 3.

Compound interest is an example of exponential growth. The  $b$  value (the number in the brackets) must be greater than 1.

The correct answer is D.

Use the following information to answer the next question.

Rhonda invested an amount of money in a GIC paying 1.75%/a, compounded annually for 5 years. The total amount of the investment at the end of the 5 year term was \$20 176.41.

4. The amount of the initial investment, or principal, can be written in the form  $KM\ N00$ , where  $K$ ,  $M$ , and  $N$  are integers. The values for  $K$ ,  $M$ , and  $N$  are, respectively, 1, 8, and 5.

### Solution

$$20\ 176.41 = \text{Principal} (1.0175)^5$$

Divide both sides of the equal sign by  $(1.0175)^5$ , in order to isolate the unknown.

$$\frac{20176.41}{(1.0175)^5} = \frac{\text{Principal}(1.0175)^5}{(1.0175)^5}$$

18500 = Principal

The values for K, M, and N are, respectively, 1, 8, and 5.

Use the following information to answer the next question.

Suppose you purchase a new car for \$38 400. It depreciates by 22% for the first year, and then depreciates by a different rate for the next 5 years. The table below shows the depreciation.

Year	Value
2	29 952
3	25 159.68
4	21 134.13
5	17 752.67
6	14 912.24

5. The depreciation rate for years 2 through 6 is

A) 20%

B) 18%

C) 16%

D) 13%

Solution

Determine the exponential regression equation that models this data.

If you use the numbers 2,3,4,5 and 6 for list one and the value numbers in the table for list two, the equation is  $y = 42448.984...(0.839...)^x$ .

If you use the numbers 1,2,3,4, and 5 for list one and the value numbers in the table for list two, the equation is  $y = 35657.154...(0.839...)^x$ .

In either case, the value for  $b$  is 0.84. To find the depreciation rate, subtract this number from one.

$$1 - 0.84 = 0.16.$$

The depreciation rate for years 2 through 6 is 16%.



Use the following information to answer the next question.

Clorinda has decided to accept her company's buy-out package of \$100 000. On her last day of work, she meets with her bank manager to get financial advice. She wants to know if she should invest the money into an account that earns 4.5%/a compounded monthly.

6. A) If Clorinda invests the money, how much will she have in her account after 5 years? [Use  $A = P\left(1 + \frac{0.045}{12}\right)^n$  ]

**Solution**

Substitute known values into the equation.

$$A = 100000\left(1 + \frac{0.045}{12}\right)^5$$

$$A = 100000(1.00375)^5$$

$$A = 100000(1.251795821)$$

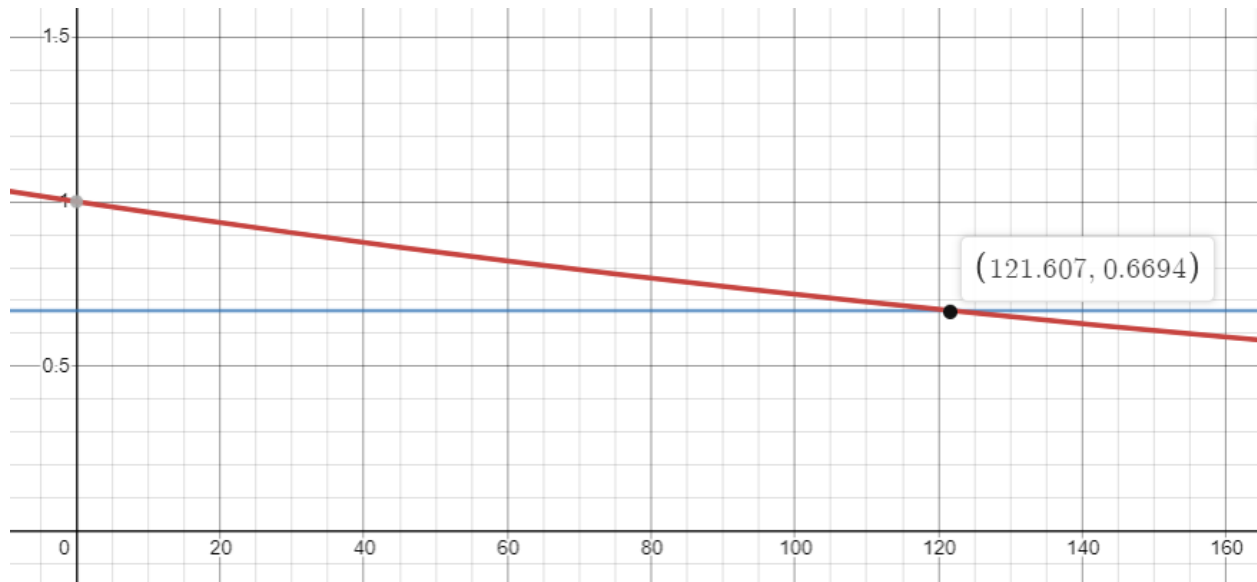
$$A = \$125\,179.58$$

- B) Determine how many months it will take Clorinda to pay off the rest of her mortgage if she applies the buy-out money towards her mortgage. Use the equation:  $(1.003\,305\,890)^{-n} = 0.669\,411$ , where n represents the number of months.

**Solution**

Graph the left side of the equal sign in  $y_1$  and the right side of the equal sign in  $y_2$ . Find the x-coordinate of the intersection point.

See the graph below.



The x-coordinate of the intersection point is 121.607.

It will take 122 months to pay off the balance of her mortgage.

Use the following information to answer the next question.

Two brothers borrowed \$12 800 from their parents to buy some new recording equipment for their musical studio. Their parents charged an interest rate of 1.5%, compounded annually. When the loan was paid off, the interest accrued was \$584.68.

7. The length of the loan, to the nearest year, was 3 years.

**Solution**

To pay off the loan, the brothers would have to cover the initial \$12 800, plus the interest of \$584.68. The sum of these numbers is \$13 384.68.

Use the compound interest formula.

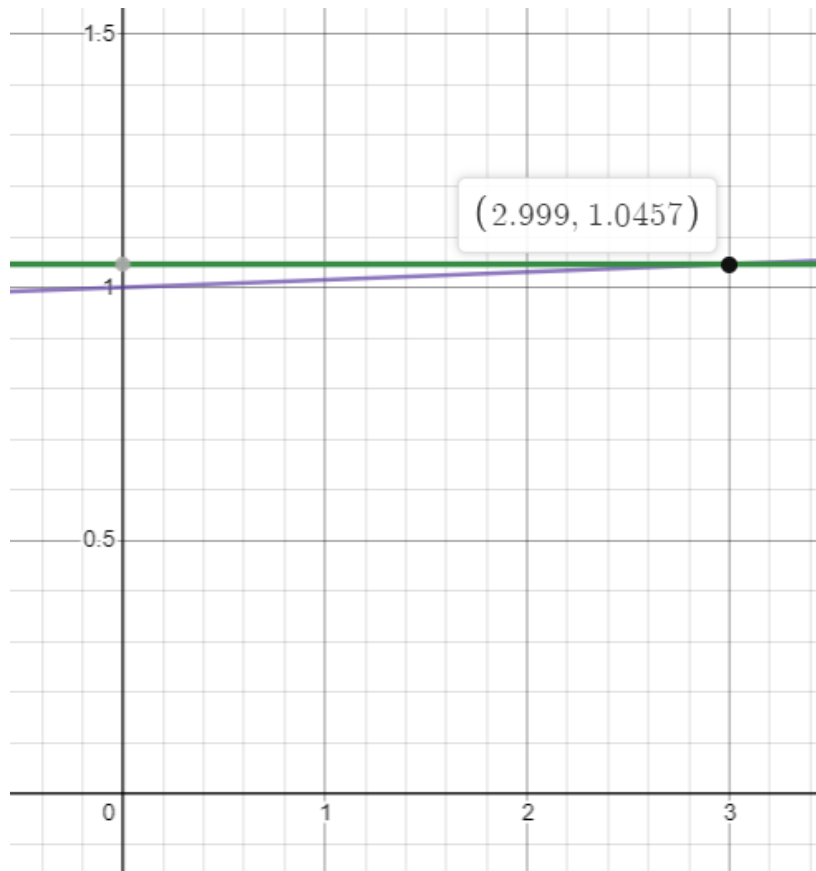
$$13\,384.68 = 12\,800(1.015)^x$$

Divide both sides by 12 800.

$$\frac{13384.68}{12800} = \frac{12800(1.015)^x}{12800}$$

$$1.04567\dots = (1.015)^x$$

Graph the left side as  $y_1$  and the right side as  $y_2$ . Find the x-coordinate of the intersection point.



The x-coordinate is 2.999.

The length of the loan, to the nearest year, was 3 years.

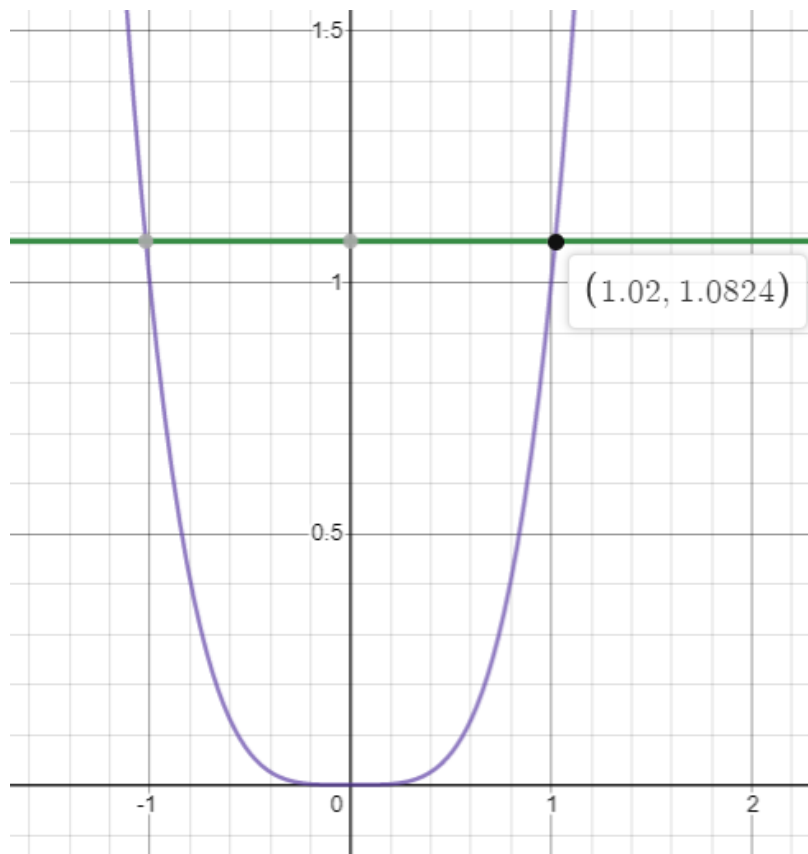
8. If \$57 000 grows to \$61 698.63 after 4 years of annual compound interest, what is the interest rate?

**Solution**

$$61\,698.63 = 57\,000(x)^4$$

$$\frac{61698.63}{57000} = x^4$$

Use the calculator to graph the left side as  $y_1$  and the right side as  $y_2$ . Determine the x-coordinate of the intersection point.



The x-coordinate of the intersection point is 1.02.

The interest rate is 2%.

Use the following information to answer the next question.

Sandy's father deposited \$1500 into an account for her when she was born. He was able to invest this money at 5% compounded annually.

9. A) How long will it take for the money to double?

**Solution**

In order to double, the new amount would be \$3000.

$$3000 = 1500(1.05)^x$$

$$2 = (1.05)^x$$

Graph both sides of the equal sign as separate functions and determine the x-coordinate of the intersection point.



The x-coordinate is (14.207).

It will take 14.2 years for the money to double.

B) How much money will Sandy have on her 20<sup>th</sup> birthday?

**Solution**

$$A = 1500(1.05)^{20}$$

$$A = 3979.95$$

On her 20<sup>th</sup> birthday, she will have \$3979.95.

- C) Suppose on her 20<sup>th</sup> birthday she wants to reinvest her accumulated amount but the interest rate is only half of the rate compared to the day she was born. Write an equation to model this scenario.

**Solution**

Half of 5% is 2.5%. As a decimal, it is 0.025.

The equation is:

$$A = 3979.95(1.025)^x.$$