

Math 30-2
Unit 6: Exponential Functions Assignment
Total: ____/29 marks

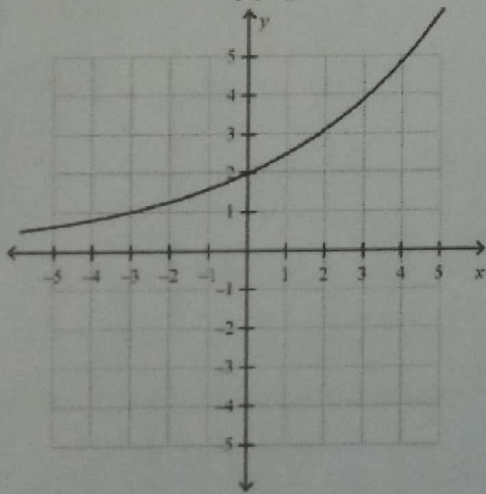
Multiple Choice

Identify the choice that best completes the statement or answers the question.

1. How many x-intercepts does the exponential function $f(x) = 2(10)^x$ have?

- ☒ A. 0
B. 1
C. 2
D. 3

2. Match the following graph with its function.



- A. $y = 3(0.5)^x$
☒ B. $y = 2(1.25)^x$
C. $y = 0.5(3)^x$
D. $y = 2(0.75)^x$

$$f(x) = 2\left(\frac{1}{3}\right)^x$$

3. Determine the y-intercept of the exponential function

A. 0

B. 1

☒ C. 2

D. 4

4. Calculate $5^{3x-8} = 25^{2x}$

☒ A. -8

B. 8

C. -4

D. 4

$$5^{3x-8} = 5^{4x}$$

$$\therefore 3x - 8 = 4x$$

$$\Rightarrow 4x - 3x = -8$$

$$\underline{\underline{x = -8}}$$

5. Solve the following exponential equation $3^{4a} = \sqrt{243}$

A. $a = \frac{3}{4}$

☒ B. $a = \frac{5}{8}$

C. $a = \frac{9}{16}$

$$\sqrt{243} = \sqrt{3^5} = 3^{\frac{5}{2}}$$

$$\therefore 3^{4a} = 3^{\frac{5}{2}}$$

$$\Rightarrow 4a = \frac{5}{2}$$

$$= a = \frac{5}{2} \div 4$$

$$= \frac{5}{8}$$

$$\underline{\underline{a = \frac{5}{8}}}$$

D. $a = \frac{7}{8}$

6. The following data set involves exponential growth. Determine the missing value from the table.

x	0	1	2	3	4	5	6
y	0.16	0.40	1.00	2.50		15.63	39.06

- A. 6.25 B. 5.00 C. 7.50 D. 8.75

$$\frac{y_2}{y_1} = \frac{1}{0.4} = 2.5$$

$$\frac{y_3}{y_2} = \frac{2.5}{1} = 2.5$$

$$\therefore \text{Ratio} = 2.5$$

$$\frac{y_4}{y_3} = 2.5$$

$$y_4 = 2.5 \times 2.5 = 6.25$$

7. Determine the equation of the exponential function for the data.

x	0	1	2	3	4	5
y	3.5	5.6	9.0	14.2	23.1	36.7

A. $y = 3.5(1.6)^x$

B. $y = 2.2(1.6)^x$

C. $y = 3.5(1.8)^x$

D. $y = 3.5(0.8)^x$

$$\text{Interval} = \frac{5.6}{3.5} = 1.6$$

$$= \frac{9}{5.6} = 1.6$$

$$= \frac{14.2}{9} = 1.6$$

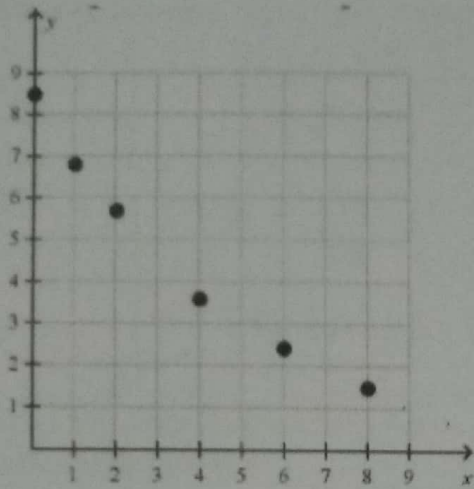
$$a = 3.5$$

$$\Rightarrow \text{Exponential equation} \\ = \underline{\underline{3.5(1.6)^x}}$$

8. A scatter plot is drawn using a data set.

Determine the value of y when x = 10.

Done Next Page



- A. 1.5
 B. -0.3
 C. 0.0
☒ D. 1.0

9. An investment can be modelled by the following growth function, where x represents the time in years:

$$y = 2500(1.018)^x$$

What was the principal invested?

- A. \$1250
☒ B. \$2500
 C. \$18
 D. \$1018

10. An investment can be modeled by the following growth function, where x represents the time in years:

$$y = 4800(1.03)^x$$

How long, in months, did it take for the account to exceed \$5000?

- A. 1
B. 9
C. 13
✓ D. 17

$$\Rightarrow \frac{4800 \times 1.03^x}{4800} = \frac{5000}{4800}$$

$$1.03^x = \frac{25}{24}$$

$$\Rightarrow x \log(1.03) = \log\left(\frac{25}{24}\right)$$

$$x = \frac{\log\left(\frac{25}{24}\right)}{\log(1.03)}$$

$$x = 1.38104 \text{ years}$$

$$\Rightarrow 1.38104 \times 12 = 16.57 \text{ months} \approx \underline{\underline{17 \text{ months}}}$$

11. To the nearest whole number, solve the following investment equation for the number of compounding periods, n.

- A. 2
✓ B. 4
C. 8
D. 16

$$350 = 300(1.04)^n$$

$$300 \times 1.04^n = 350$$

$$\frac{300 \times 1.04^n}{300} = \frac{350}{300}$$

$$1.04^n = \frac{7}{6}$$

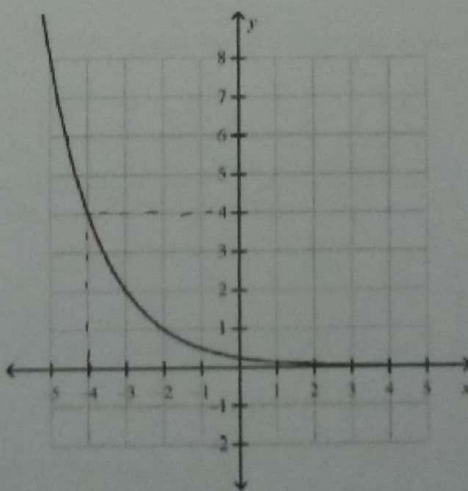
$$n \log(1.04) = \log\left(\frac{7}{6}\right)$$

$$n = \frac{\log \frac{7}{6}}{\log 1.04}$$

Written Response

Please show/explain all of your work for full marks.

1. Use the graph of an exponential function shown below.



a. Estimate the x-value at $y = 4$. (1 mark)

$$\text{When } y = 4, x = -4$$

b. Estimate a possible value of "b" if the general form of an exponential function is $a(b)^x$? (1 mark)

$$4 = 0.5(b)^{-4} \quad | \quad 0.5 = 4b^4$$

$$4 = \frac{0.5}{b^4}$$

$$4b^4 = \frac{0.5}{b^4} b^4$$

2. Solve the following exponential equation algebraically. Verify your solution by graphing. (2 marks)

$$1000 = 10^{2a-1} \quad | \quad 1000 = 10^{2a-1}$$

$$10^3 = 10^{2a-1} \quad | \quad 2a = 3+1 = 4$$

$$3 = 2a-1 \quad | \quad a = \frac{4}{2}$$

$$a = \underline{\underline{2}}$$

3. Determine whether the following data set involves exponential growth, exponential decay, or neither. Explain how you know. (2 marks)

x	1	2	3	4	5	6
y	5	15	45	135	405	1215

$\times 3 \quad \times 3 \quad \times 3 \quad \times 3 \quad \times 3$

Since the domain values are at regular intervals and the range values have a common factor, the data are exponential.

4. The fish population in Loon Lake is modelled by the equation $P(t) = 2500(0.92)^t$, where P represents the number of fish and t represents the time, in years, since 2010.

Estimate the fish population in 2030. (1 mark)

$$2030 - 2010 = 20$$

$$P(t) = 2500(0.92)^{20}$$

$$= 472$$

5. A vehicle was purchased for \$15 000 in 2005. The book value of the vehicle can be modelled by the exponential function

Year	2005	2006	2007	2008	2009	2010
Number of Years Since 2005, t	0	1	2	3	4	5
Value of Vehicle, $V(t)$	\$15 000	\$12 300	\$10 086	\$8270.52	\$6781.83	\$5561.10

where V represents the value in dollars and t represents the time, in years, after 2005.

a) Determine the exponential regression that represents the value of the vehicle of the past 5 years. Round your numbers to the nearest hundredth. (1 mark)

$$V = 15000(0.82)^t$$

b) How does the value of the vehicle change over time? Explain how you know. (2 marks)

Value of the vehicle is decreasing over time. If you calculate the value at $t = 0, 1, 2, 3, 4, 5$ you can notice in the graph that value of the vehicle is decreasing when time increasing.

c) Estimate the value of the vehicle in 2015. Show your work. (1 mark)

$$t = 2015 - 2005 = 10 \text{ years}$$

$$V = 15000(0.82)^{10} = 2061.7204 = \$2061.72$$

6. Solve the equation and verify your answer by substitution. Show your work. (2 marks)

$$6(8)^{5-x} = 3072$$

$$\frac{6 \times 8^{5-x}}{6} = \frac{3072}{6}$$

$$8^{5-x} = 512$$

$$8^{5-x} = 8^3$$

$$5-x = 3$$

$$= x = 5-3$$

$$x = 2$$

7. Thorium-227 has a half-life of 18.4 days. The remaining amount of a 50-mg sample of thorium-227 can be modeled by the equation

$$A(t) = 50 \left(\frac{1}{2} \right)^{\frac{t}{18.4}}$$

where A is the amount of thorium-227 remaining, in milligrams, and t is the time in days.

a) Determine when 12.5 mg of thorium-227 are remaining. Show your work. (1 mark)

$$50 \left(\frac{1}{2} \right)^{\frac{t}{18.4}} = 12.5 \quad \left| \left(\frac{1}{2} \right)^{\frac{t}{18.4}} = \frac{1}{4} \right| \quad t = 36.8 \text{ days}$$

$$\frac{50 \left(\frac{1}{2} \right)^{\frac{t}{18.4}}}{50} = \frac{12.5}{50} \quad \left| -\frac{t}{18.4} = -2 \right| \quad \underline{\underline{\approx 37 \text{ days}}}$$

b) Use a **graphing calculator** to determine when 5 mg of thorium-227 are remaining, to the nearest day.

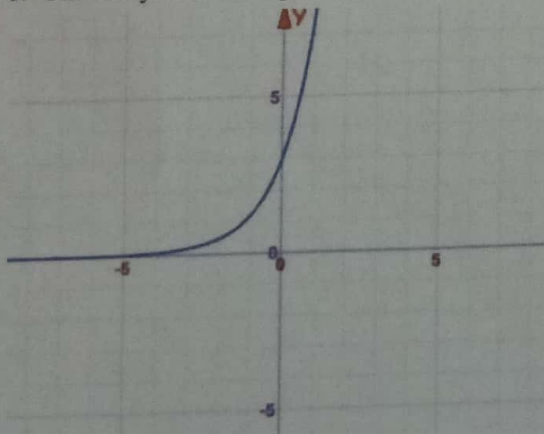
Show your work. (1 mark)

$$5 = 50 \left(\frac{1}{2} \right)^{\frac{t}{18.4}} \quad \left| \left(\frac{1}{2} \right)^{\frac{t}{18.4}} = \frac{1}{10} \right| \quad \underline{\underline{\approx 61 \text{ days}}}$$

$$50 \left(\frac{1}{2} \right)^{\frac{t}{18.4}} = 5 \quad \left| \frac{t}{18.4} \log \left(\frac{1}{2} \right) = \log \frac{1}{10} \right|$$

$$\frac{50 \left(\frac{1}{2} \right)^{\frac{t}{18.4}}}{50} = \frac{5}{50} \quad \therefore t = 61.12$$

8. Chloe says that the equation $y = 3(2.5)^x$ represents the graph below.



a. Can she be possibly correct? Explain your answer. (2 marks)

Yes, she is correct.

This is so because the curve cuts the y -axis at 3.

b. What is the range of the graph? (1 mark)

The range of this graph is $(0, \infty)$, $\{y | y > 0\}$