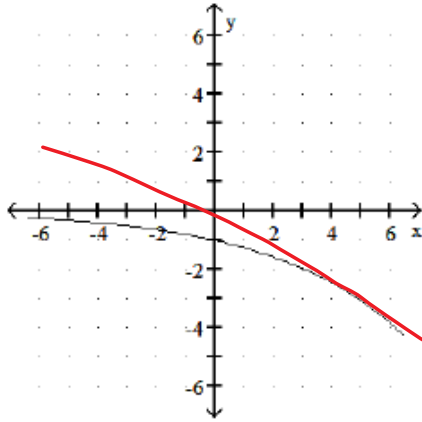


Part I: Multiple Choice. Place the correct answer in the corresponding blank at the end of this section.

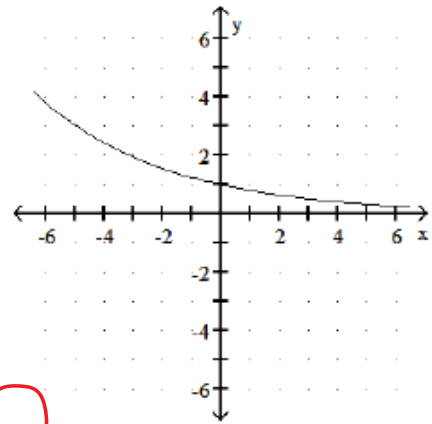
Formulae:  $A = P(1 + rt)$        $A = P(1 + i)^n$

1. Which selection is the best model for the graph of the function  $f(x) = \left(\frac{5}{4}\right)^x$ ?

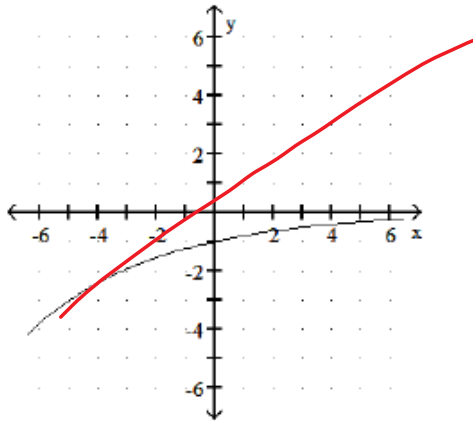
A)



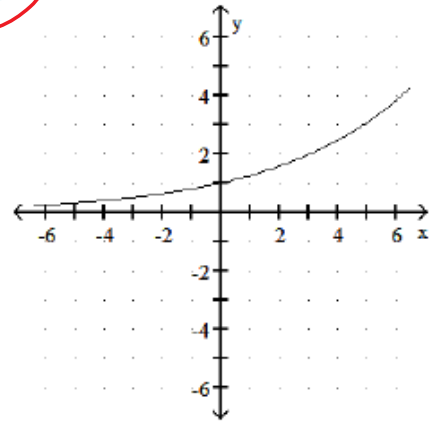
B)



C)



D)



2. Which table represents an exponential function?

(A)

<del>x</del>	<del>y</del>
<del>1</del>	<del>2</del>
<del>2</del>	<del>6</del>
<del>3</del>	<del>10</del>
<del>4</del>	<del>14</del>

$\frac{6}{2} = 3$   
 $\frac{10}{6} = \frac{5}{3}$

(B)

<del>x</del>	<del>y</del>
<del>1</del>	<del>3</del>
<del>2</del>	<del>5</del>
<del>3</del>	<del>9</del>
<del>4</del>	<del>16</del>

$\frac{5}{3} = \frac{5}{3}$   
 $\frac{9}{5} = \frac{9}{5}$

(C)

<del>x</del>	<del>y</del>
<del>1</del>	<del>96</del>
<del>2</del>	<del>24</del>
<del>3</del>	<del>8</del>
<del>4</del>	<del>4</del>

$\frac{24}{96} = \frac{1}{4}$   
 $\frac{8}{24} = \frac{1}{3}$

(D)

x	y
1	64
2	16
3	4
4	1

$\frac{16}{64} = \frac{1}{4}$   
 $\frac{4}{16} = \frac{1}{4}$

3. Which equation will produce a decay curve? *decreasing*

(A)  $y = 8(3)^{\frac{x}{2}}$

(B)  $y = 2\left(\frac{4}{3}\right)^x$

(C)  $y = \frac{1}{2}(6)^x$

(D)  $y = 6\left(\frac{1}{3}\right)^x$  *0.666...*

4. A coffee is sitting on Mr. McGill's desk, cooling. It cools according to the function  $T = 70(0.80)^x$ , where  $x$  is the time in minutes and  $T$  is the temperature in degrees Celsius. What is the initial temperature of the coffee?

(A) 0

(B) 0.8

(C) 56

(D) 70

$70$   
 $T = 70(0.8)^0 = 70(1) = 70$

5. Using the equation from question 4 determine the temperature of the coffee after a  $\frac{1}{2}$  hour. = 30

- (A) 0.09  
 (B) 35  
 (C) 62.6  
 (D) 0.4

$$y = 70(0.8)^{30} = 0.09$$

6. Determine the equation of the exponential function represented in the table.

- (A)  $f(x) = 15\left(\frac{1}{4}\right)^x$   
 (B)  $f(x) = 15(4)^x$   
~~(C)  $f(x) = 4(15)^x$~~   
~~(D)  $f(x) = 4\left(\frac{1}{15}\right)^x$~~

0	1	2	3	4
15	60	240	960	3840

$$\frac{60}{15} = 4$$

7. The formula describing the decay of the radioactive isotope radium-226 is:  $A = A_0 \left(\frac{1}{2}\right)^{\frac{t}{1620}}$ , where  $A$  is the amount of radium present at time  $t$ ,  $A_0$  is the original quantity of radium and  $t$  is the time in years. Which statement best describes this function?

- (A) Radium has a half-life of 1620 years.  
 (B) The amount of Radium doubles every 1620 years.  
 (C) The decay rate 16.2%  
 (D)  $A_0$  will decay to 50% of its original amount after 1620 seconds.

8. Select the exponential function that models the situation and find the value after the given time.

\$100 investment; 2.5% gain in value each year; find the value after 3 years.

- (A)  $f(x) = 100(2.5)^x$ , value = \$1562.50  
~~(B)  $f(x) = 1.025(100)^x$ , value = \$1 025 000~~  
~~(C)  $f(x) = 0.025(100)^x$ , value = \$25 000~~  
 (D)  $f(x) = 100(1.025)^x$ , value = \$107.69

$$0.025 + 1$$

9. Select the exponential function that satisfies the given conditions. Initial mass = 0.6 g, doubling every 3 days.

- (A)  ~~$f(x) = 0.6(3)^{2x}$~~   
 (B)  $f(x) = 0.6(2)^{3x}$   
 (C)  ~~$f(x) = 0.6(3)^{\frac{x}{2}}$~~   
 (D)  $f(x) = 0.6(2)^{\frac{x}{3}}$

$y = a(b)^{\frac{x}{n}}$

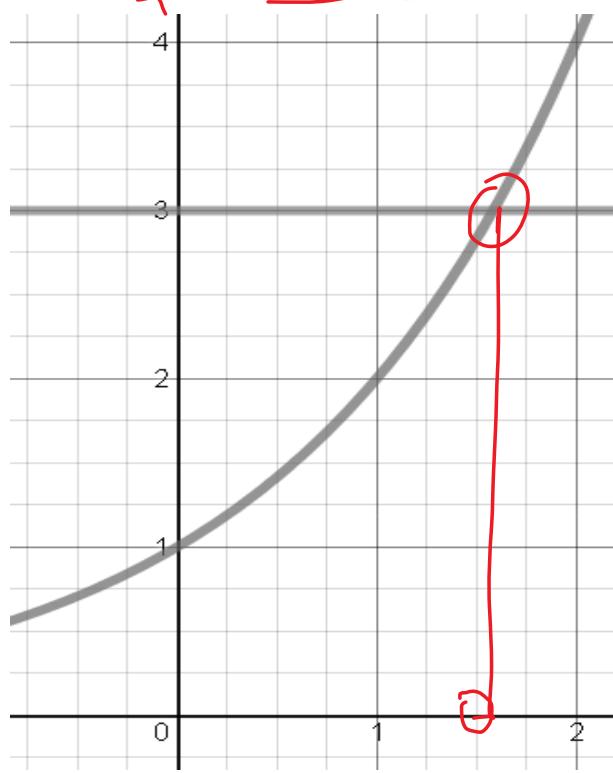
10. A single-cell organism doubles every 4 days. How many days will it take one organism to become a population of 512 organisms?

- (A) 4.5  
 (B) 9  
 (C) 18  
 (D) 36

$512 = (2)^{\frac{x}{4}}$   
 $2^9 = 2^{\frac{x}{4}}$   
 $9 = \frac{x}{4}$   
 $x = 36$

11. Use the graph to solve  $2^{x+1} = 3$ .

- (A)  $x = 0$   
 (B)  $x = 1.5$   
 (C)  $x = 1.6$   
 (D)  $x = 3$



12. The function  $y = 5^x$  passes through which of these points?

- (A) (5, 1)  ~~$1 \neq 5^5$~~   
 (B) (-1, 5)  ~~$5 \neq 5^{-1}$~~   
 (C) (1, 5)  $5 = 5^1$   
 (D) (5, -1)

13. Consider this function;  $y = a(b)^x$ , where  $0 < b < 1$ . Which statement best describes the function?

- (A) does not exist
- (B) is decreasing
- (C) is increasing
- (D) is negative

14. Evaluate  $f(x) = 6^{1-x}$ , when  $x = 3$ .

- (A)  $\frac{1}{36} = 6^{1-3}$
- (B)  $\frac{1}{12} = 6^{-2}$
- (C)  $12 = \frac{1}{6^2}$
- (D)  $36 = \frac{1}{36}$

15. The number of bacteria grown in a lab increases with time according to the equation  $f(x) = 5200(5)^t$ , where  $t$  is the time measured in days. After how many days will the number of bacteria be 650,000?

- (A) 1
  - (B) 3
  - (C) 6
  - (D) 10
- $650000 = 5200(5)^t$   
 $\frac{650000}{5200} = \frac{5200(5)^t}{5200}$   $t = 3$   
 $125 = 5^t$   
 $5^3 = 5^t$

**Answers to multiple choice.**

1.\_\_\_\_ 2.\_\_\_\_ 3.\_\_\_\_ 4.\_\_\_\_ 5.\_\_\_\_

6.\_\_\_\_ 7.\_\_\_\_ 8.\_\_\_\_ 9.\_\_\_\_ 10.\_\_\_\_

11.\_\_\_\_ 12.\_\_\_\_ 13.\_\_\_\_ 14.\_\_\_\_ 15.\_\_\_\_

**Part II: Constructed Response. Answer each question in the space provided. Show all workings.**

16. A local zoo starts a breeding program to ensure the survival of a species of swan. They determine that the equation that describes the population growth is given by  $P = 40(1.15)^n$ , where  $n$  is the time measured in years.

(A) How big is the initial population of swans purchased by the zoo?

$$40$$

(B) Find the expected population after 8 years.

$$P = 40(1.15)^8 = 122$$

17. Solve for  $x$ . Show your steps.

(A)  $3^{3x+4} = 3 \cdot 3^{2x}$

$$3^{x+4} = 3^{1+2x}$$

$$3x+4 = 1+2x$$

$$3x-2x = 1-4$$

$$x = -3$$

(B)  $8^{x+1} = 16^{4-x}$

$$2^{3(x+1)} = 2^{4(4-x)}$$

$$2^{3x+3} = 2^{16-4x}$$

$$3x+3 = 16-4x$$

$$3x+4x = 16-3$$

$$7x = 13$$

$$x = 13/7$$

(C)  $8 \cdot 2^{x-2} = \frac{1}{32}$

$$2^3 \cdot 2^{x-2} = \frac{1}{2^5}$$

$$2^{3+x-2} = 2^{-5}$$

$$2^{x+1} = 2^{-5}$$

$$x+1 = -5$$

$$x = -5-1$$

$$x = -6$$

(D)  $25^x \cdot 5 = 625$

$$\frac{25^x}{5} = \frac{625}{5}$$

$$25^x = 125$$

$$5^{2x} = 5^3$$

$$\frac{2x}{2} = \frac{3}{2}$$

$$x = 3/2$$

18. The appreciation of a comic book is determined using the formula  $y = 3.99(1.2)^x$ , where  $x$  is time measured in years.

(A) What is the original price of the comic book?

$$\$3.99$$

(B) Find the value of the comic in 50 years.

$$y = 3.99(1.2)^{50} = \$36310.75$$

19. Determine whether the data in each table display exponential behavior. Explain why or why not.

(A)

x	2	5	8	11
y	480	120	30	7.5

$$\frac{120}{480} = \frac{1}{4} \quad \text{Yes.}$$

$$\frac{30}{120} = \frac{1}{4} \quad \text{b-values are equal.}$$

$$\frac{7.5}{30} = \frac{1}{4}$$

(B)

x	21	18	15	12
y	30	23	16	9

$$\frac{23}{30} \quad \text{No}$$

$$\frac{16}{23} \quad \text{b-values are not equal.}$$

$$\frac{9}{16}$$

20. In 2010 a person invested \$25,000. The investment grew by 4% annually and was compounded annually.

(A) Identify and correct the error(s) in the function a student used to model the value of the investment since 2010. Explain your reasoning.

STUDENT'S WORK  $1+0.04$

$$A(2015) = 25,000(0.04)^{2015}$$

$$A = 25000(1.04)^5$$

(B) Determine the true value of the investment in 2015.

$$\$30416.32$$