Mathematics 5 SN

Exponential Functions

1 The following formula calculates the total amount f(t) of money in an account into which $1000 was deposited with compound interest for t years at a rate of interest i.

$$f(t) = 1000(1 + i)^t$$

What is the range of this function? ($i > 0$)

A) $\mathfrak{R}_+^*$

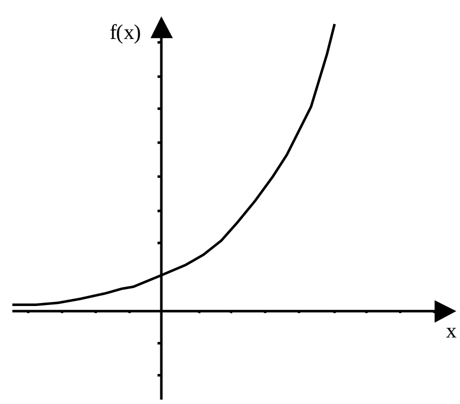
B) $\mathfrak{R}$

C)]0, 1000[

D) [1000, ∞

2 Given the exponential function f(x) = $\boldsymbol{a}^x$ represented by the graph at the right.

What is a possible value for base $\boldsymbol{a}$?



A) -4

B) $\frac{-1}{4}$

C) $\frac{1}{4}$

D) 4

3

The accumulated value $V(t)$, in dollars, of an initial investment V_o, in dollars, after a period of t years, compounded annually at a fixed interest rate i is given by the equation :

$V(t) = V_o\,(1 + i)^t$ where $t \geq 0$

Investment ($)	Rate (%)
0 – 1000	3.00
1001 – 2000	3.25
2001 – 5000	3.50
5001 and +	4.00

Isabelle wants to invest $1000 at the rate of 3 %, as indicated in the chart above. After a period of *t* years, the investment would have a value of $1125.51. Her father feels that she should invest $1001 for the same period of time because of the higher interest rate.

How much more will be earned in interest alone if Isabelle invests $1001 at the higher rate instead of $1000 at the lower rate?

A) $7.42

B) $11.10

C) $12.22

D) $137.61

4 After studying the evolution of a population of 2000 gulls, biologists concluded that the population increased by 15 % every two years.

If this rate of growth is maintained, which rule can be used to find the number N of gulls there will be in *t* years?

A) $N(t) = 2000 \times (0.15)^{\frac{t}{2}}$

C) $N(t) = 2000 \times (1.15)^{\frac{t}{2}}$

B) $N(t) = 2000 \times (0.15)^{2t}$

D) $N(t) = 2000 \times (1.15)^{2t}$

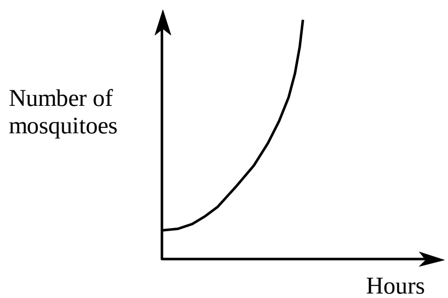
5 Find the value of *x* in

$$\frac{1}{9} = \exp_x(-2)$$

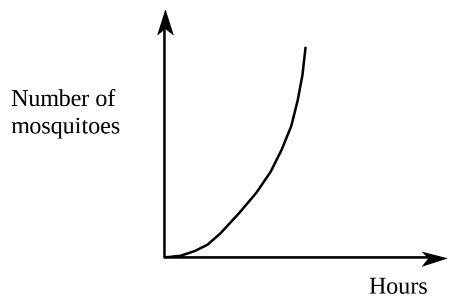
____

6 Under laboratory conditions, a mosquito population triples every 4 hours. If the initial population was 200 mosquitoes, which of the following graphs best illustrates the population growth of these insects?

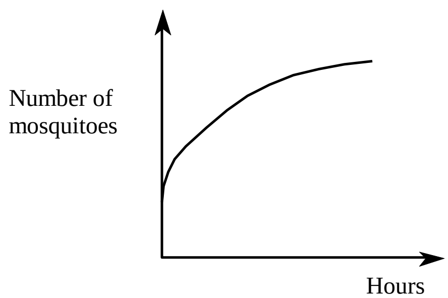
A)



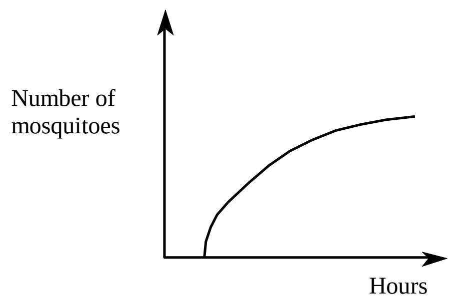
C)



B)



D)



7 To cover the cost of building a water filtration plant, a municipality is planning an average tax increase of 6 % per year starting in 1994.

Mr. Blais paid $1225 in taxes for the year 1993. He wants to find a function t that can be used to calculate the amount of annual taxes as a function of the number of years n elapsed since 1993.

What rule corresponds to function t?

The rule that corresponds to function t is ____.

8 A certain radioactive substance, whose initial mass is 100 g, decays in such a way that after one year only 90 % of it is still radioactive. This situation can be expressed by the following equation :

$$m(t) = 100 \times 0.9^{t}$$

where m(t) is the remaining mass after t years have elapsed.

What is the range of this function for the first 2 years?

A) $\Re_{+}$

B) [0, 81]

C) [0, 100]

D) [81, 100]

9 Paula, a renowned biologist, has brought back some exotic mosquitos into the country to study their genetic behaviour.

This species of mosquitos doubles its population every eight days.

This situation is represented by the following equation :

$$\mathrm{n}(d) = 2 \times 2^{\frac{d}{8}}$$

where n(d) is the number of mosquitos at the end of the d^{th} day.

At the end of the 128$^{\text{th}}$ day, the colony is attacked by a virus and 40 % of the population is destroyed.

How many mosquitos are left?

A)	26 214	C)	52 428
B)	39 321	D)	78 643

10 The following formula is used to calculate the amount of money, A(t), that accumulates in a bank account when \$5000 is invested at a fixed rate of interest i and compounded annually for t years.

$$A(t) = 5000(1 + i)^t \quad \text{where } t \geq 0$$

What is the range of this function?

A) $\Re^*_+$

B) $\Re$

C) $]0, 5000]$

D) $[5000, +\infty$

11 During an experiment in a science laboratory, a population of 100 mosquitoes triples every 12 hours.

What rule can be used to calculate the number of mosquitoes Q(t) as a function of the number of days t?

The rule is Q(t) = _______________.

12 The following function is used in a probability study:

$$p(t) = 0.6e^{-0.6t}$$

where $e \approx 2.718$ and t represents time

Given the following three statements.

1. The function $p(t)$ is decreasing.
2. The equation of its asymptote is $y = 0$.
3. The y intercept of the function is 1.

Which of these statements are TRUE?

A) Only 1 and 2

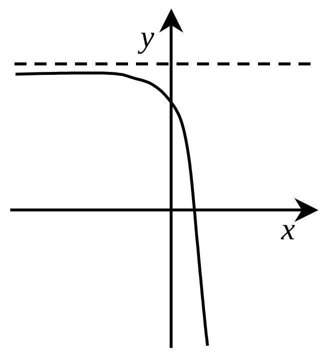
B) Only 1 and 3

C) Only 2 and 3

D) 1, 2 and 3

13 The rule of a function g is $g(x) = p(c)^x + q$. The equation of its asymptote is $y = 8$. This function is represented by the table of values and the graph given below.

x	y
0	6
1	2
2	-10

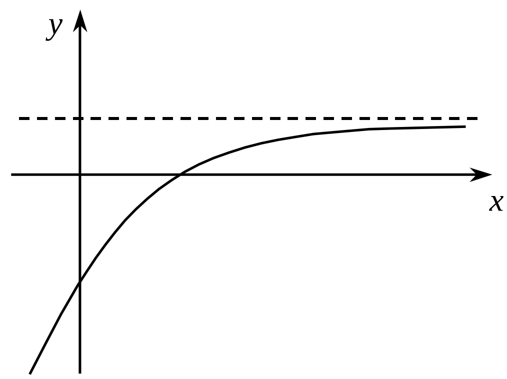


What is the rule of function g?

The rule of function g is $g(x)$ = _____________________.

14 Given function f defined by the rule : $f(x) = ac^{b(x-h)} + k$ where $0 < c < 1$.

Function f is represented in the Cartesian plane below.



What are the possible values of parameters a and b ?

A) $a > 0$
$b > 0$

B) $a > 0$
$b < 0$

C) $a < 0$
$b > 0$

D) $a < 0$
$b < 0$

15 Electronic mail makes it easy to contact many people rapidly. Justin received a message on Monday. The next day he sent it to 12 people. The following day, each of those 12 recipients sent the message to 12 people, and so on.

On what day will the message have been sent exactly one million times?

The message will have been sent to exactly one million people on __________.

16 Consider an exponential function of the form $f(x) = ac^{b(x-h)} + k$ where $c > 1$.

If $a > 0$, $b < 0$, $h < 0$, $k > 0$

Which of the following is TRUE?

A) f is decreasing and has no zero.

B) f is increasing and has no zero.

C) f is decreasing and has one zero.

D) f is increasing and has one zero.

2- Correction key

1 D

2 D

3 B

4 C

5 3

6 A

7 The rule that corresponds to function t is $t(n) = 1225 \times 1.06^n$ or any equivalent rule.

8 D

9 D

10 D

11 The rule is $Q(t) = 100 \times 3^{2t}$

or any equivalent rule.

12 A

13 The rule of function g is $g(x) = \mathbf{-2(3)^{x} + 8}$.

14 C

15 The message will have been sent to exactly one million people on **Sunday**.

16 A