1

$$x^2 - 2mx = -9$$

$$x^2 - 2mx + 9 = 0$$

What is the (minimum) positive integer value of **m** that allows the above equation to have **two** real solutions?

+ve

$$b^2 - 4ac > 0$$

$a = 1$

$b = -2m$

$c = 9$

$$(-2m)^2 - 4(1)(9) > 0$$

$$4m^2 - 36 > 0$$

$$4m^2 > \frac{36}{4}$$

$$m^2 > \sqrt{9}$$

$$m > 3$$

4, 7, ...

2

$$2x^2 - 4x = t$$

In the equation above, t is a constant. If the equation has no real solutions, which of the following could be the value of t?

$a = 2$

$b = -4$

$c = -t$

A) -3

B) -1

C) 1

D) 3

$$2x^2 - 4x - t = 0$$

$$b^2 - 4ac < 0$$

$$(-4)^2 - 4(2)(-t) < 0$$

$$16 + 8t < 0$$

$$8t < -\frac{16}{8}$$

$$t < -2$$

3

$$m x^2 + 4x + 2 = 0$$

$a = m$

$b = 4$

$c = 2$

In the equation above, What is the positive value of m if the equation has one real solution? $= 0$

$$b^2 - 4ac = 0$$

$$(4)^2 - 4(m)(2) = 0$$

shift Solve

$$m = 2$$

4

$$2x^2 + bx + 8 = 0$$

In the equation above, b is a constant. For what positive value of b does the equation have exactly $0 =$ one real solution?

$a = 2$

$b = b$

$c = 8$

$$b^2 - 4ac = 0$$

$$b^2 - 4(2)(8) = 0$$

shift Solve

$$b = 8$$

5

$$x^2 - ax + 6 = 0$$

In the equation above, What is the minimum positive value of a if the equation has two real solutions?

$a = 1$

$b = -a$

$c = 6$

$$b^2 - 4ac > 0$$

$$(-a)^2 - 4(1)(6) > 0$$

$$a^2 - 24 > 0$$

$$a^2 > \sqrt{24}$$

$$a > 2\sqrt{6}$$

4.9

5

6

$$x^2 - ax + 6 = 0$$

In the equation above, What is the minimum positive value of a if the equation has two real solutions?

1

If $h(x) = -x^2+3x-2$ and $k(x) = -2x-5$, what is the value of $h(k(-2))$?

A. -6
B. -4
C. 0
D. 2

(handwritten:) $k(-2) = -2(-2)-5 = -1$

$h(-1) = -(-1)^2+3(-1)-2 = -6$

2

Find the value of x in the equation

$$6v^2 + 3 = -2v$$

(handwritten:) $a = 6$ $b = 2$ $C = 3$

$6v^2+2v+3 = 0$

$\dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

$\dfrac{-2 \pm \sqrt{}}{12}$

A) $\dfrac{4+\sqrt{76}}{12}$

B) $\dfrac{-4+\sqrt{76}}{12}$

C) $\dfrac{2+2\sqrt{19}}{6}$

D) No solution

3
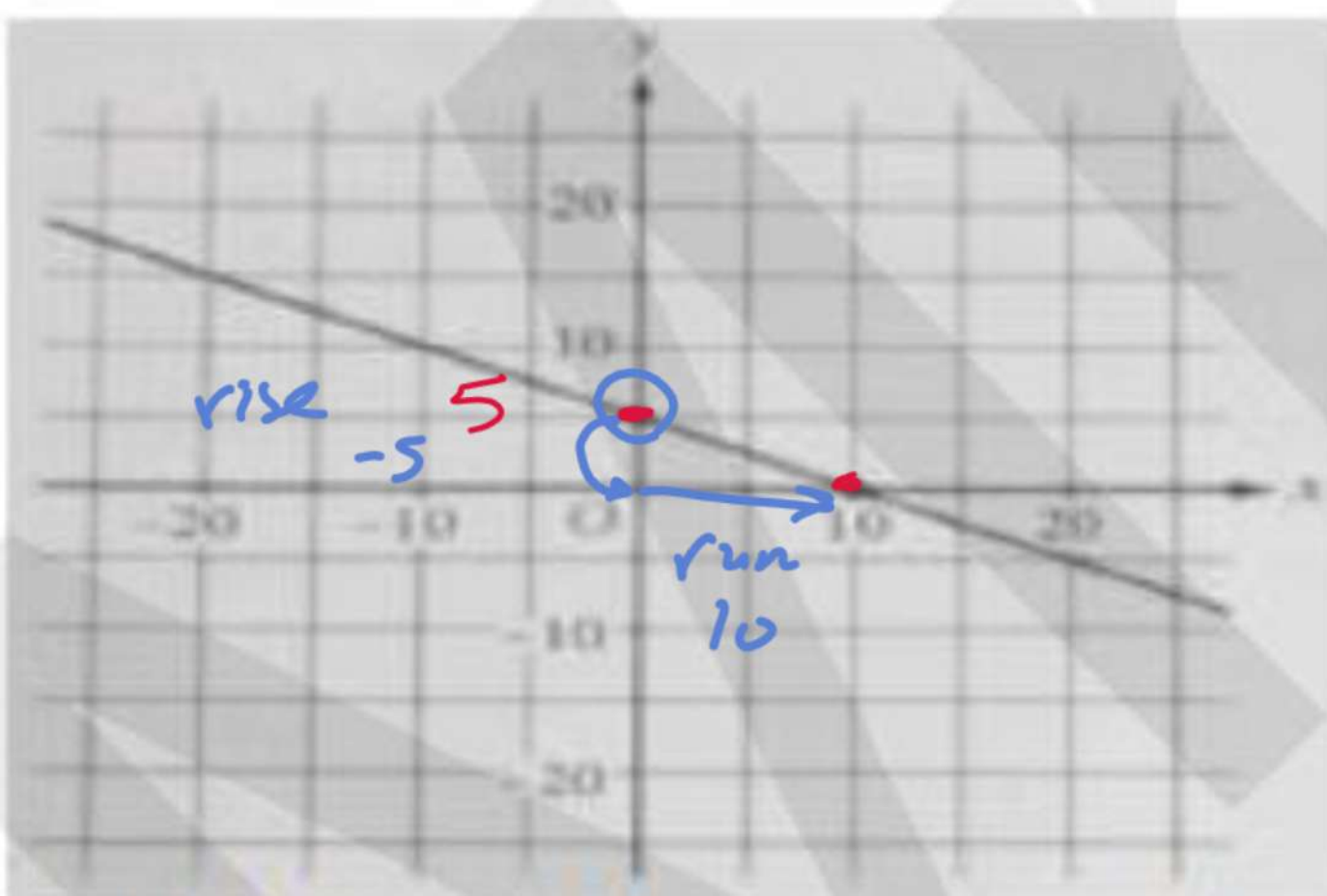
Which of the following is an equation of the line graphed in the xy-plane above?

A) $y = -\dfrac{1}{2}x+10$

B) $y = -\dfrac{1}{2}x+5$

C) $y = -2x+10$

D) $y = -2x+5$

(handwritten:) rise -5, run 10, $\dfrac{rise}{run} = \dfrac{-5}{10} = -\dfrac{1}{2}$

4

For a function f, $f(-1)=12$ and $f(1)=16$. If the graph of $y=f(x)$ is a line in the xy-plane, what is the slope of the line?

(handwritten:) $(-1,12)$ $(1,16)$

$m = \dfrac{y-y}{x-x}$

$= \dfrac{16-12}{1-(-1)} = 2$

5

What is the product of the solutions of the equation $x^2 - 3x = -2$? (Grid-in)

(handwritten:) $x^2-3x+2 = 0$

2

6

Sarah ordered a set of golf clubs and a golf bag online, which were shipped to her house. The weight w, in pounds, of the bag and the clubs is estimated by the equation $w=1.2c+13$, where c is the number of clubs in the bag. What is the best interpretation of the number 1.2 in the equation?

A) The estimated weight, in pounds, of 1 club
B) The estimated weight, in pounds, of 13club
C) The estimated weight, in pounds, of the bag with no clubs
D) The estimated weight, in pounds, of the bag with 13 clubs

(handwritten:) $y = mx+b$
slope — y-int
Average rate — initial starting
Y Per x — at x=0

1

If a salesperson receives a base pay of 800 EGP per month and a 5% commission on sales, what is the equation relating sales (a) and the monthly income (b) for this person?

A. $b = 800a + 0.05$
B. $b = 0.05a + 800$
C. $a = 800b + 0.05$
D. $a = 0.05b + 800$

2

$x\frac{1}{4}$ $\div 4$

A house is losing a fourth of its value every year. Which of the following best describes the relationship between time (in years) and the value of the house?

A) Increasing linear
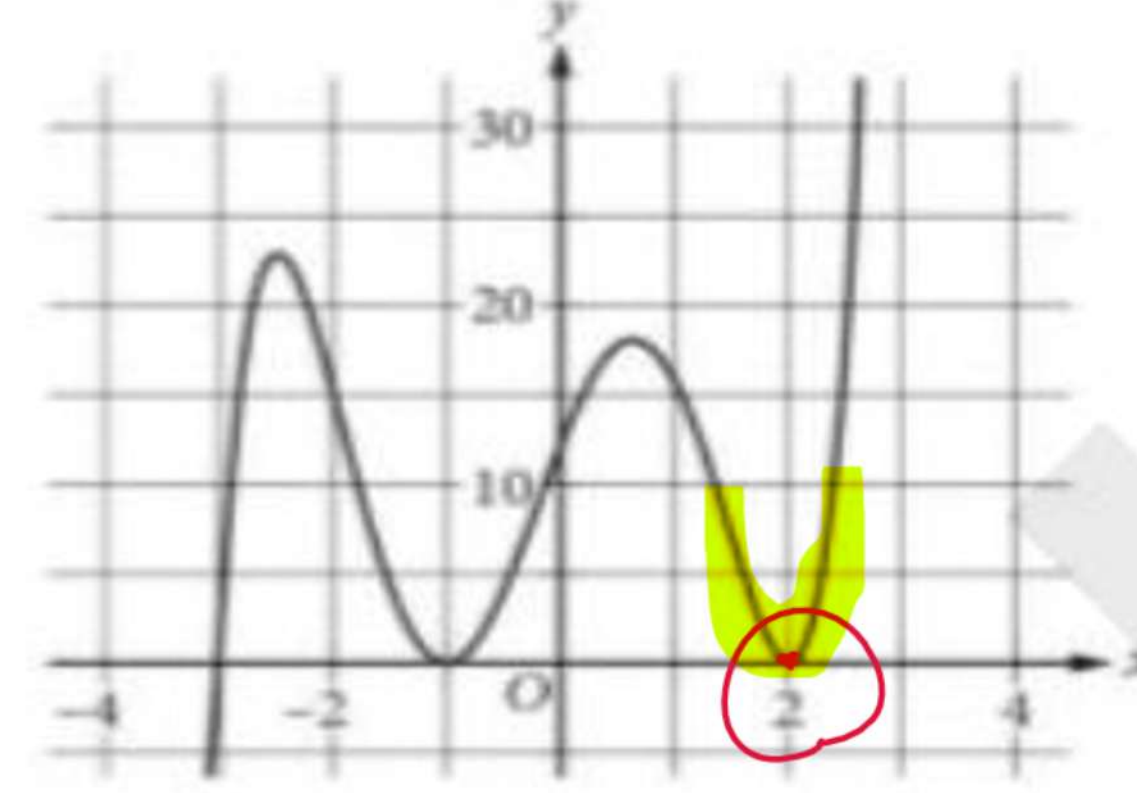B) Decreasing linear
C) Exponential growth
D) Exponential decay

3

$$y = 7x^2 - 28x + 21$$

The graph of the equation above is a parabola in the xy-plane. In which of the following equivalent forms of the equation do the x-intercepts of the parabola appear as constants or coefficients?

A) $y = 7(x^2 - 4x) + 21$
B) $y = 7x(x - 4) + 21$
C) $y = 7(x - 2)^2 - 7$ verter, Max, Min
D) $y = 7(x - 1)(x - 3)$ x-int, routs, Solo

4

$(x-2)^2$

The graph of the function f is shown in the xy plane above, where $y = f(x)$. Which of the following functions could define f?

A. $f(x) = (x - 3)(x - 1)^2(x + 2)^2$
B. $f(x) = (x - 3)^2(x - 1)(x + 2)$
C. $f(x) = (x + 3)(x + 1)^2(x - 2)^2$
D. $f(x) = (x + 3)^2(x + 1)(x - 2)$

5

If $f(x) = -2x + 6$, then $f^{-1}(x) =$

$x = -2y + 6$

A. 2-x/6
B. 2/6-x

$\dfrac{x - 6}{-2} = -2y$

C. 6-x/2
D. 2x-6

6

$a = 2$
$b = b$
$c = 8$

$$2x^2 + bx + 8 = 0$$

In the equation above, b is a constant. For what positive value of b does the equation have exactly one real solution?

$= 0$

$b^2 - 4ac = 0$

$b^2 - 4(2)(8) = 0$

shift Solve $b = 8$

1

$x_v = \dfrac{-b}{2a}$

What is the **abscissa** of the vertex of the function $f(x) = 3x^2 - 18x + 4$? (grid-in)

$a = 3$

$b = -18$

$C = 4$

$\dfrac{-b}{2a} = \dfrac{+18}{2(3)}$

$= \dfrac{18}{6}$

$= 3$

2

The height of a launched cannonball can be described as a function of time according to the following quadratic equation:

$$h(t) = -2t^2 + 14t + 36$$

$\dfrac{Max}{Min} \Rightarrow vertex$

What is the **maximum** height attained by the cannonball?

$a = -2$

$b = 14$

$C = 36$

A. 60.5
B. 36
C. 9
D. 2

$x_v = \dfrac{-b}{2a}$

$= \dfrac{-14}{2(-2)}$

$= 3.5$

$y = -2(3.5)^2 + 14(3.5) + 36$

$= 60.5$

3

$a = 2$

$b = a$

$C = -1$

Given $f(x) = 2x^2 + ax - 1$. What is the value of a if the **axis of symmetry** of the graph of f is equal to -2.5 ?

A. -10
B. 5
C. 10
D. 20

$x_v = \dfrac{-b}{2a}$

$\dfrac{-a}{2(2)} = -2.5$

shift
some

Mr. Kably

1

The selling price of an apartment is directly proportional its area. If an apartment of 127 sqm is sold for $168,275, what would be the price of a 156 sqm apartment?

A. 237,900$
B. 208,500$
C. 136,993$
D. 206,700$

$$sqm \qquad \$$$
$$\frac{127}{156} \diagdown \frac{168\ 275}{x}$$

$$\frac{156 \times 168\ 275}{127} = 206\ 700$$

2

In 2007, a watch manufacturer found that 2 out of every 30 watches produced are defected.

If the manufacturer produces 2 million watches in a year, which of the following is closest to the estimated number of non-defected watches?

A. 1,866,000
B. 1,867,000
C. 133,000
D. 134,000

$$\begin{array}{cc} non & Total \\ 28 & 30 \\ x & 2000\ 000 \end{array}$$

$$x = \frac{28 \times 2000\ 000}{30} = 1866,666$$

3

Horsepower and watts are units of measure of power. They are directly proportional such that 5 horsepower is equal to 3730 watts. How much power, in watts, is equal to 2 horsepower?

$$\begin{array}{cc} HP & watt \\ 5 & 3730 \\ 2 & x \end{array}$$

$$\frac{2 \times 3730}{5} = 1492$$

4

Bob is paid an hourly rate. One week he earned 165 $ by working 30 hours. If he works 40 hours the next week, how much will he earn?

5

The concentration of solution in sugar is directly proportional to the mass of sugar dissolved in the solution. If the concentration of a solution is 1.5mol/L when 54g are dissolved, how many grams are dissolved if the concentration is 2.1mol/L?

6

The distance a certain object travels is proportional to the amount of time the object is in motion. If the object travels 60 feet in 20 seconds, how many feet does the object travels in 90 seconds?

A) 30
B) 50
C) 130
D) 270

Mr. Kably

7

Maria downloaded to her music library a total of 350 pop and rock songs. If the ratio of pop to rock song is 3 to 11. How many rock songs are there in Maria's library?

A. 75
B. 125
C. 175
D. 275

Handwritten work:

$$\frac{P : R : \text{Total}}{3 : 11 : 14}$$

$$x : 350$$

$$x = \frac{11 \times 350}{14}$$

$$= 275$$

8

Handwritten: Cross X

If y varies directly as the cube of $2x$, and $y = 8$ when $x = 2$, what is y when x is equal to 4 ? (grid-in)

Handwritten work:

$$y \qquad (2x)^3$$
$$8 \qquad (2\times2)^3$$
$$y \qquad (2\times4)^3$$

$$\frac{8 \times (2\times4)^3}{(2\times2)^3} = 64$$

9

Tanta University is an Egyptian university located in Tanta, Egypt. Since 1962, the administration was developed and was able to create more than 10 faculties. Statistics show, in an old release, that 3,636 students attend the Faculty of Medicine, and the ratio of female students to male students is 11:25. How many male students are attending the faculty?
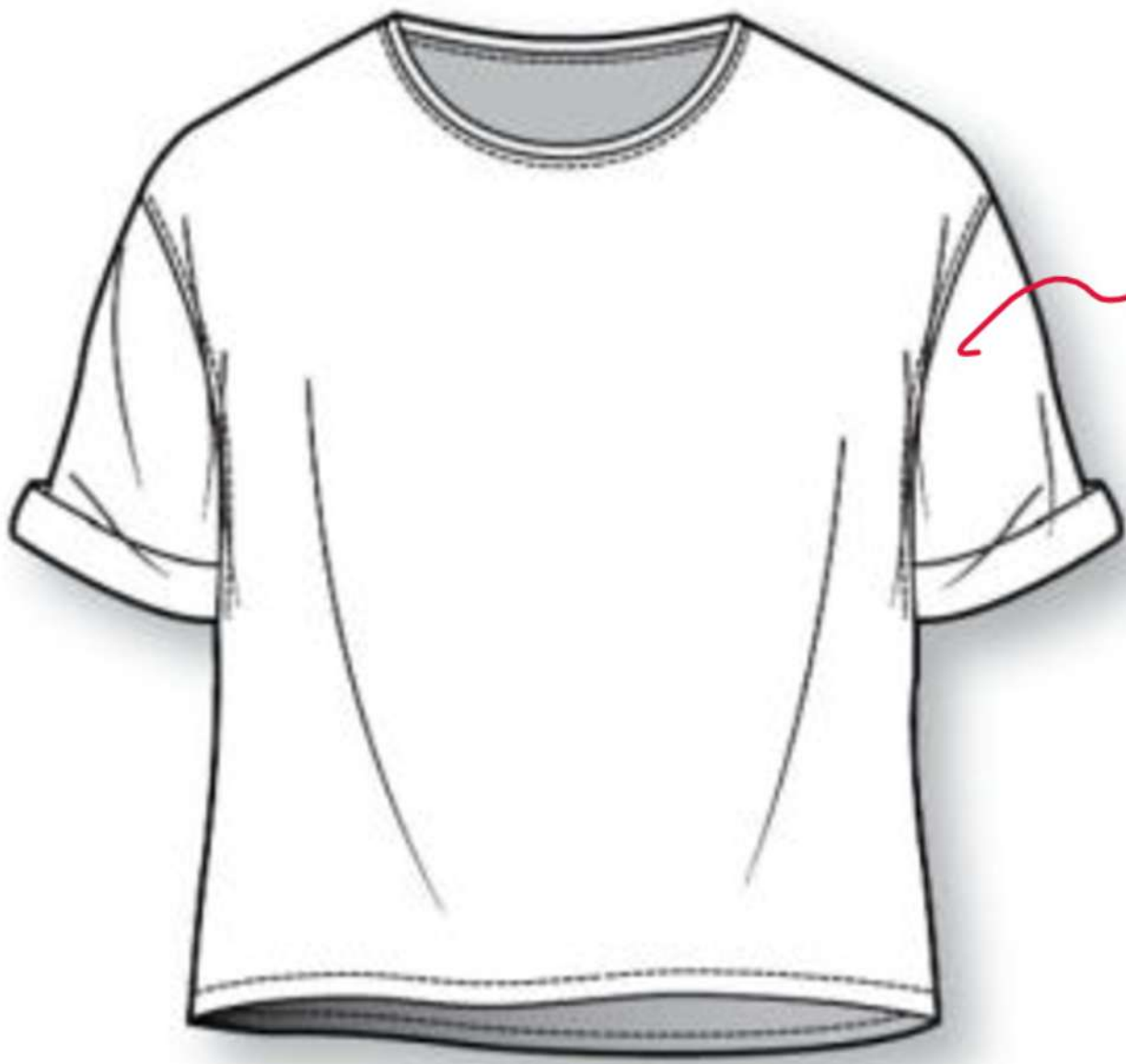
A. 2,544
B. 2,525
C. 2,000
D. 1,604

10

If h varies inversely as k, and $h = 9$ when $k = 20$, what is the value of $k + 4$ when $h = 15$? (grid-in)

Math is Root of Knowledge

MATH = $\sqrt{}$ KNOWLEDGE

$ 150

DISC 20%

80 % × 150

0.80 × 150

$50

rAT %14

114 % × 50

1.14 × 50

50 % + 36%

0.50 × 0.70 = 0.35

Math is Root of Knowledge

MATH = √KNOWLEDGE

1

$0.80 \times 0.74 \times 130$

A company lost **20%** of their stock the first year, then **26%** the second year. In the third year, their stock increased by **30%**. Which of the following statements is true?

0.7696

76.96%

A. The company's stock increased by 23.04% in comparison with the price of the stock before the start of the loss.

B. The company's stock decreased by **23.04%** in comparison with the price of the stock before the start of the loss.

~~C.~~ The company's stock decreased by 76.96% in comparison with the price of the stock before the start of the loss.

~~D.~~ The company's stock increased by 76.96% in comparison with the price of the stock before the start of the loss.

2

From 2018 to 2019, the amount in Julias's bank account increased by 22.5% to $14325. To the nearest dollar, what was the initial amount in her bank account?

$122.5\% \; x = 14325$

$1.225 \, x = \dfrac{14325}{1.225}$

A. 11694$

$x = 11694$

B. 14010$

C. 11102$

D. 12775$

3

A local supermarket offered a discount of 15% on its items after the government raised all the prices by 25%. Overall, by what percentage were the original prices raised in this supermarket in particular?

A. 8.625%
B. 7.250%
C. 6.250%
D. 5.625%

4

The budget for a school band was $8,000 in 2010. The budget decreased by 15% from 2010 to 2011 and then increased by 22% from 2011 to 2012. Which of the following expressions represents the budget, in dollars, for the school band in 2012?

A. (1.15)(1.22)(8,000)

B. (0.85)(1.22)(8,000)

C. (1.15)(0.78)(8,000)

D. (0.85)(0.78)(8,000)

5

The price of the COVID-19 vaccine in the black market was first increased by 15% and then increased by 10% after two weeks. What is the percent increase in the price of the vaccine?

1.15×1.10

A. 126.5%

$= 1.265 \times 100$

B. 26.5%

$= 126.5\%$

C. 25%

D. 1.265%

6

If the speed of an airplane is now 127% of its previous speed, which of the following must also be true?

A) The speed of the airplane has increased by 27% from its previous speed.

B) The speed of the airplane has increased by 73% from its previous speed.

C) The speed of the airplane is now 127 miles per hour.

D) The speed of the airplane is now 27 miles per hour faster than its previous speed.

7

A stock increased in value by 7% on Wednesday and then decreased in value by 4% on Thursday. What was the net percentage increase in the value of the stock from the end of the day on Tuesday to the end of the day on Thursday?

A) 2.72%

B) 2.88%

C) 3.00%

D) 3.28%

8

$$c(t) = 1,870(1.025)^t$$

The function above models the number of capybaras, $c(t)$, living in a section of tropical forest in Brazil, where t is the number of years since 2010. Which of the following is the best interpretation of the value 1.025 in the context?

A) Each year, the number of capybaras is increasing by approximately 1 from the preceding year.

B) Each year, the number of capybaras is increasing by approximately 25 from the preceding year.

C) Each year, the number of capybaras is increasing by approximately 2.5% from the preceding year.

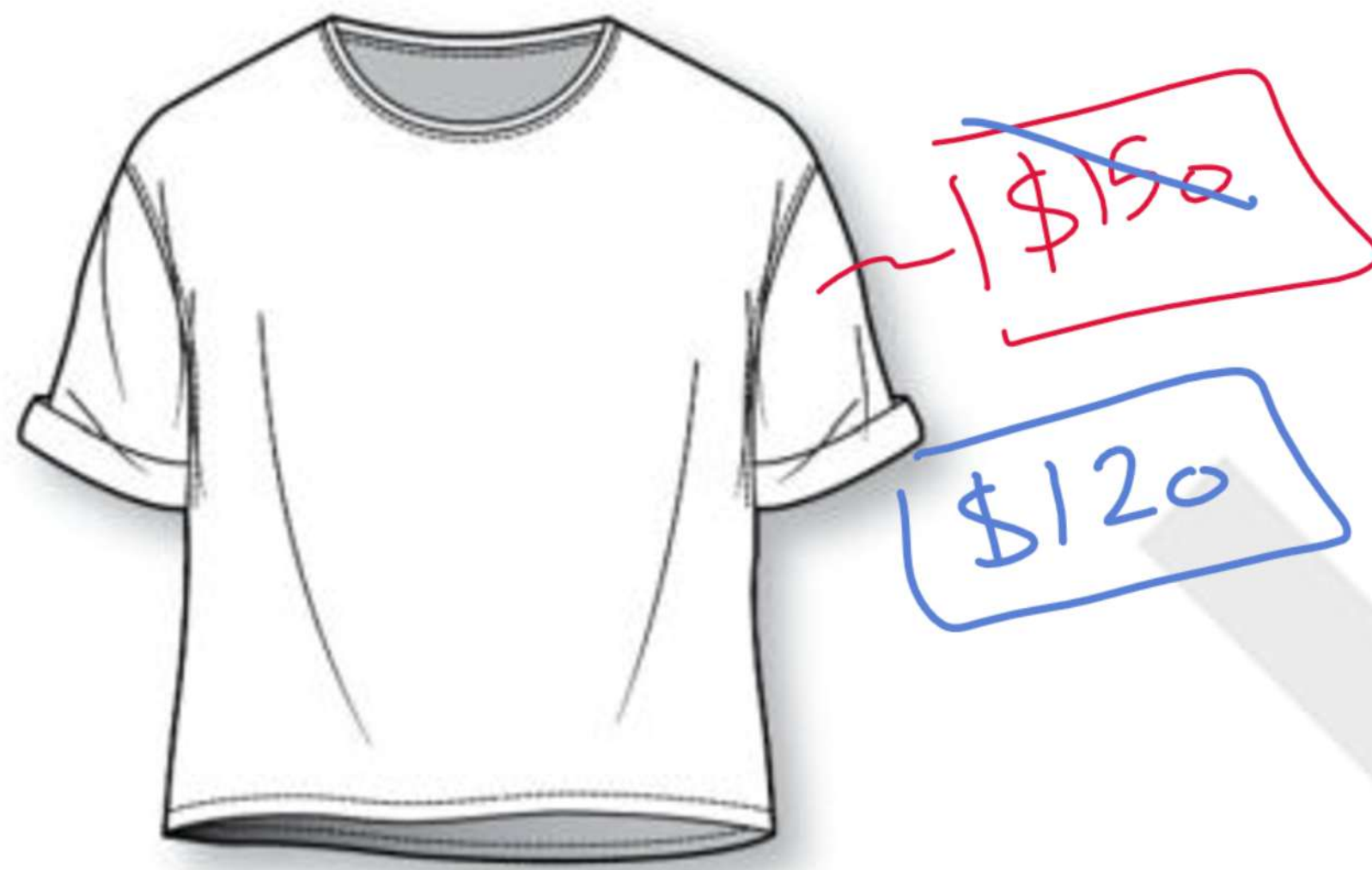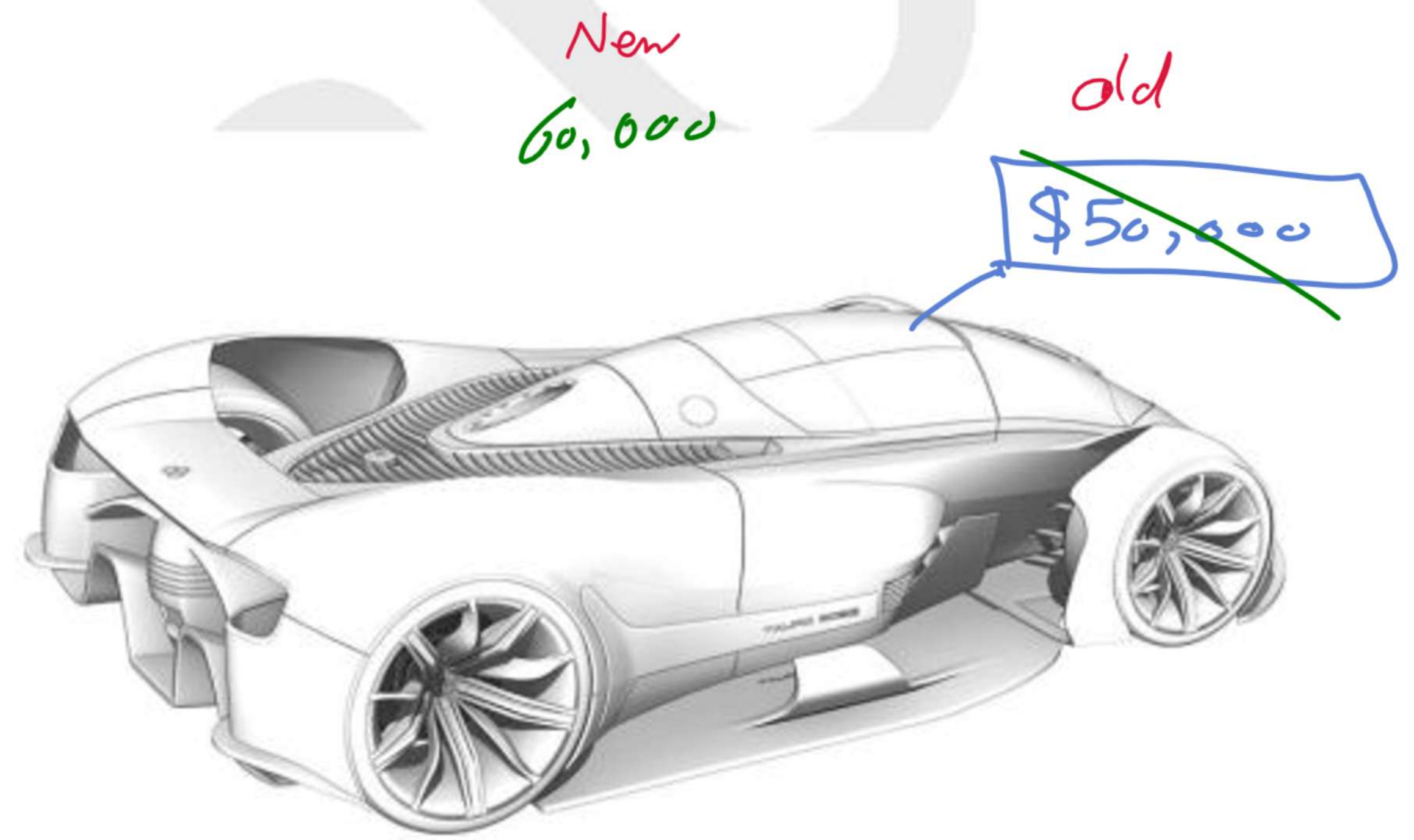D) Each year, the number of capybaras is increasing by approximately 125% from the preceding year.

Mr. Kably

$$\% \text{ Change} = \frac{New - old}{old} \times 100$$

$$\% \text{ Change} = \frac{N - O}{O} \times 100$$

$$= \frac{120 - 150}{150} \times 100$$

~~150~~

$120

New
60,000

old
~~$50,000~~

$$\frac{N - O}{O} \times 100$$

$$\frac{60000 - 50000}{50000} \times 100$$

MATH = √KNOWLEDGE

Math is Root of Knowledge

1

The original price of an article is 30,000 EGP **[old]** and its discount price is 27,600 **[New]** EGP. What is the discount percent?

$$\frac{N-O}{O} \times 100$$

$$\frac{27600 - 30000}{30000} \times 100 = -8$$

⬭ 8

2

Gold is one of the most important items in the world. Its price increases and decreases every day. The average closing price for the past 8 years is shown in the table below.

Year	Average Closing Price ($)
2020	1,771.9 **[New]**
2019	1,393.34
2018	1,268.93 **[Old]**
2017	1,251.92
2016	1,158.86
2015	1,266.06
2014	1,409.51
2013	1,668.86

Which of the following statements is true when comparing the annual percentage change from 2018 to 2020?

A. It increased by 27.17%.
B. It decreased by 27.17%.
C. It decreased by 39.64%.
D. It increased by 39.64%.

$$\frac{N-O}{O} \times 100$$

$$\frac{1771.9 - 1268.93}{1268.93} \times 100$$

$$= 39.64$$

3

A magazine article on video game habits in the United States reported that in 2012 gamers spent an average of 5.6 hours per week playing games. The article also reported the average for 2013 to be 6.3 hours per week. Based on the article, how did the average number of hours that gamers spent playing games per week change from 2012 to 2013?

A. It decreased by 12.5%.
B. It increased by 7.0%.
C. It increased by 11.1%.
D. It increased by 12.5%.

4

Census blocks are geographic areas defined by the US Census Bureau. The residents in each block are counted each decade. The table below shows the total number of census blocks for the 5 states that had the cost census blocks in 2000 and 2010.

State	Number of census blocks in 2000	Number of census blocks in 2010
Alaska	21,874	45,292
Hawaii	18,990	25,016
Delaware	17,483	24,115
Rhode Island	21,023	25,181
Vermont	24,824	32,580
Total for these 5 states	104,194	152,184

What was the percent increase in the number of census blocks in Delaware from 2000 to 2010, rounded to the nearest tenth of a percent? (Disregard the % sigh when gridding your answer. For example, if your answer is 78.2%, grid 78.2)

Mr. Kably

Final   initial   ← intervals

$$A = P(1 \pm r)^t$$

P

$5000 , 10\% , 4$ year

$$A = P(1 \pm r)^t$$

$$= 5000(1.10)^4$$

The Compound Interest Formula

Amount   Interest Rate (decimal)

$$A = P\left(1+\frac{r}{n}\right)^{nt}$$ ← Time

Principal   Number of times interest is compounded per unit 't'

thecalculatorsite.com

Math is Root of Knowledge

MATH = √KNOWLEDGE

$A = P(1 \pm r)^t$

1

In the year **1990**, **12000** tourists visited country X. Due to bad weather conditions, the number of tourists visiting country X started **decreasing by 10%** per year. How many more tourists visited country X in the year 1993 than the year 2000? (Give the answer to the nearest whole number).

(1993)   (2000)

$12000(0.90)^3 — 12000(0.90)^{10}$

$= 4563$

2

In 2011, the population in Cairo was **9.12 million.** Considering the population was increasing by 1% each year, what could be the approximate population in Cairo in **2022?**

P

A. 10.074154 million
B. 10.123200 million
C. 10.174896 million
D. 10.276645 million

$A = P(1 \pm r)^t$

$= 9.12(1.01)^{11}$

3

James adds to an oil tank 10 liters on day 1, then every day he adds 50% the amount he filled the day before.

After 1000 days, how much oil is there approximately in the tank?

4

A company purchased a piece of equipment for $40,000. Each year after the year of purchase, the value of the equipment is estimated to be 10% less than its value the previous year. Which of the following is closest to the estimated value of the equipment 4 years after it was purchased?

A) $2,000

B) $8,000

C) $24,000

D) $26,000