Chapter 10. Quadratic And Exponential Functions

Ex. 10.5

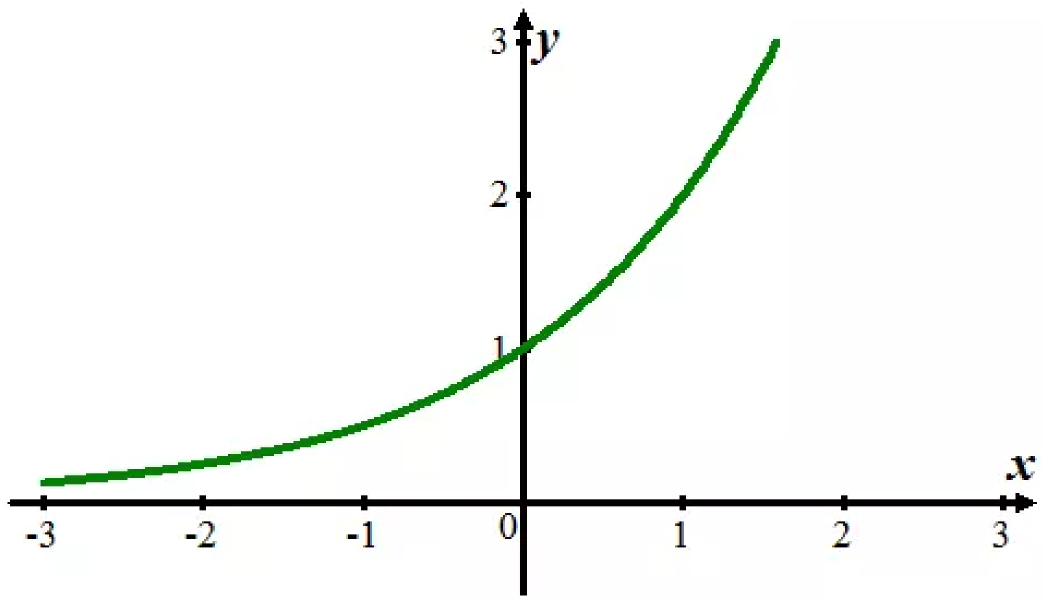
Answer 1CU.

The equation is $y = a^x$ where $a > 0$.

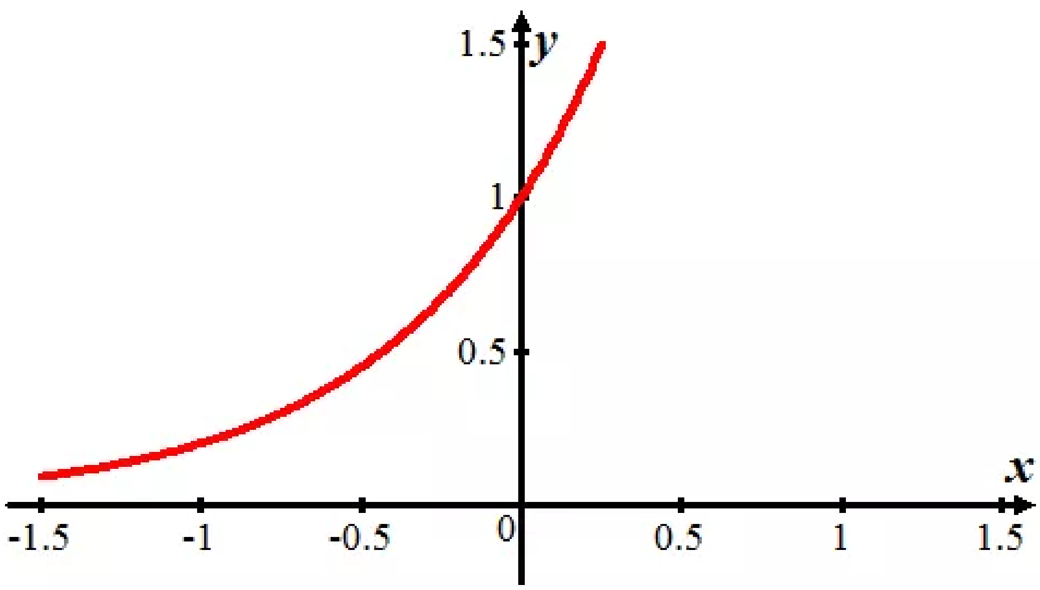
Need to verify whether it cuts x – axis.

Take different values for a and sketch the graphs.

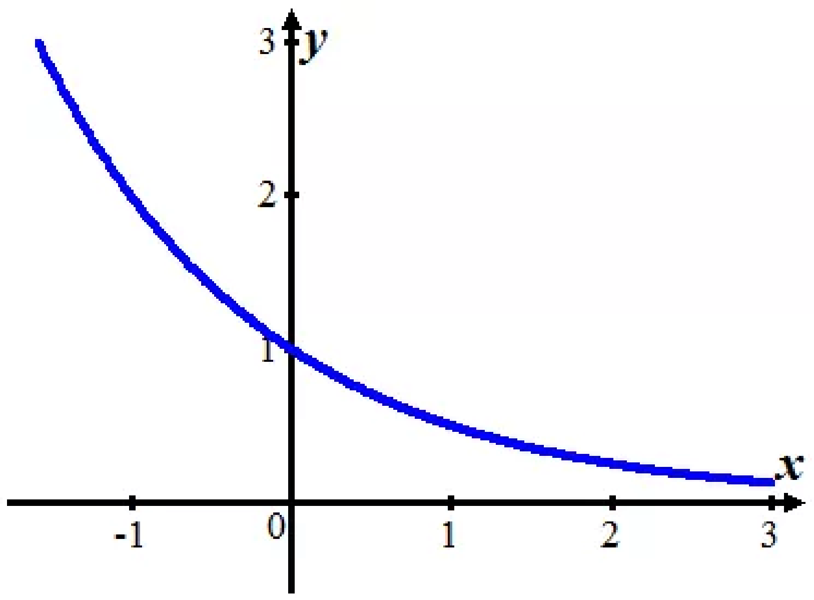
The graph of $y = 2^x$ is shown below:



The graph of $y = 5^x$ is shown below:



The graph of $y=\left(\frac{1}{2}\right)^x$ is shown below:



The graph of the function of the form $y = a^x$ where $a > 0$ is never meets for x – axis for any real value of x.

Therefore, the graph $y = a^x$ where $a > 0$ never cuts x – axis.

Answer 1PQ.

Consider the equation $x^2 + 2x = 35$

Claim: Solve the equation by quadratics formula.

Step1: Re-write the equation $x^2 + 2x = 35$ by the standard quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$

$$x^2 + 2x = 35 \quad \text{(Original equation)}$$
$$x^2 + 2x - 35 = 35 - 35 \quad \text{(Subtract 35 on both sides)}$$
$$x^2 + 2x - 35 = 0$$

Step2: Now solve the equation $x^2 + 2x = 35$ by quadratic formula

Now, compare the equation $x^2 + 2x = 35$ with the standard quadratic equation we obtain that $a = 1; b = 2 \text{ and } c = -35$

Use the formula: "The solution of the quadratic equation $x^2 + 2x = 35$ where $a \neq 0$ are given by the quadratic form $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad \text{(Original formula)}$$

$$x=\frac{-2\pm\sqrt{(2)^2-4(1)(-35)}}{2(1)} \qquad \text{(Replace } a \text{ by 1, } b \text{ by 2, and by } -35\text{)}$$

$$=\frac{-2\pm\sqrt{4+140}}{2}$$

$$=\frac{-2\pm\sqrt{144}}{2}$$

$$=\frac{-2\pm 12}{2} \qquad \left(\sqrt{144}=12\right)$$

$$x=\frac{-2+12}{2} \quad \text{or} \quad x=\frac{-2-12}{2}$$

$$x=\frac{10}{2} \quad \text{or} \quad x=\frac{-14}{2}$$

$$x=5 \quad \text{or} \quad x=-7$$

Therefore x = 5 (or) $x=-7$

Step3: Check:

Substitute each value of x in the original equation $x^2+2x=35$

$$x^2+2x=35 \qquad \text{(original equation)}$$

$$(-7)^2+2(-7)=35 \qquad \text{(Replace } x \text{ by } -7\text{)}$$

$$49-14\overset{?}{=}35$$

$$35=35 \qquad \text{True}$$

$$x^2+2x=35 \qquad \text{(original equation)}$$

$$(5)^2+2(5)=35 \qquad \text{(Replace } x \text{ by 5)}$$

$$25+10\overset{?}{=}35$$

$$35=35 \qquad \text{True}$$

therefore $x=-7$ and $x=5$ satisfies the equation $x^2+2x=35$

Hence, the solution set is $\boxed{\{-7,5\}}$

Answer 2CU.

An exponential function is a function that can be described by on equation of the form $y = a^x$, where $a > 0$ and $a \neq 1$

Example Graph $y = 5^x$ (green curve)

Now we construct the table for $y = 5^x$

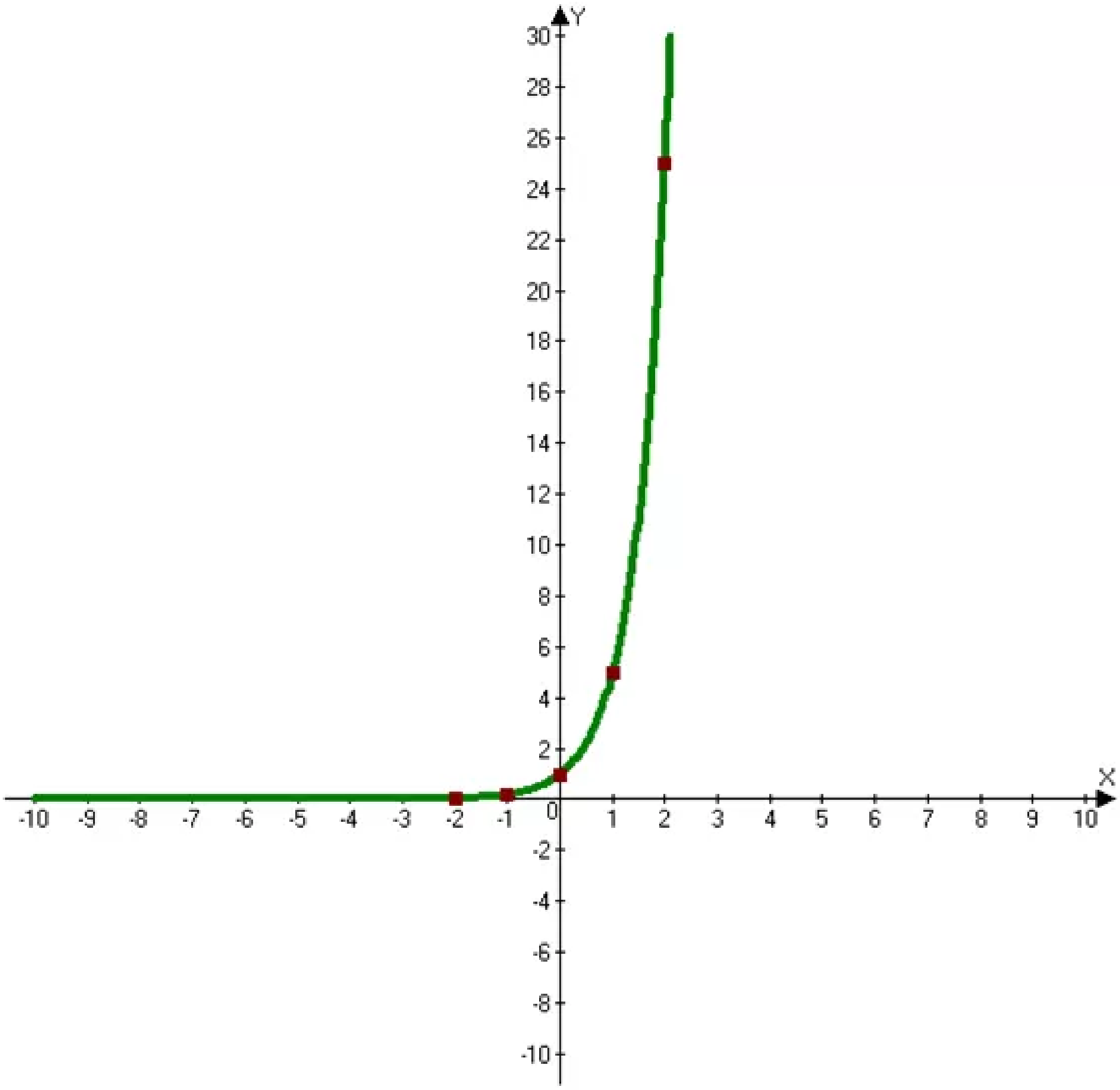
To substitute different values of *x* in the original function $y = 5^x$ to get the different values of *y*. plotting these all ordered pairs and connect them with a smooth curve.

Table for $y = 5^x$

x	5^x	y
-2	$5^{-2} = \frac{1}{25}$	$\frac{1}{25}$
-1	$5^{-1} = \frac{1}{5}$	$\frac{1}{5}$
0	$5^0 = 1$	1
1	$5^1 = 5$	5
2	$5^2 = 25$	25

Add these all ordered pairs (brown dots) to get a smooth curve.

The *y* – intercept is 1.



Y
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
X
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9 10

Answer 2PQ.

Consider the equation $2n^2 - 3n + 5 = 0$

Claim: Solve the equation $2n^2 - 3n + 5 = 0$ by quadratics formula.

Now, compare the equation $2n^2 - 3n + 5 = 0$ with the standard quadratic equation we obtain that $a = 2; b = -3, c = 5$ and $x = n$

Use the rule: "The solution of the quadratic equation $2v^2 - 4v = 1$ where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad \text{(Original formula)}$$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(5)}}{2(2)} \qquad \left(\begin{array}{l}\text{Replace } a \text{ by } 2,\ b \text{ by } -3,\ c \text{ by } 5 \\ \text{and } x \text{ by } n\end{array}\right)$$

$$= \frac{3 \pm \sqrt{9 - 40}}{4}$$

$$= \frac{3 \pm \sqrt{-31}}{4}$$

$$= \frac{3 \pm \sqrt{-1} \cdot \sqrt{31}}{4} \qquad \left(\sqrt{-1} = i\right)$$

$$= \frac{3 \pm i \cdot \sqrt{31}}{4}$$

$$n = \frac{3 + i\sqrt{31}}{4} \quad \text{or} \quad n = \frac{3 - i\sqrt{31}}{4}$$

Therefore, the roots of the equation $2n^2 - 3n + 5 = 0$, n is complex

Hence, there is $\boxed{\text{no real roots}}$ of the equation $2n^2 - 3n + 5 = 0$

Answer 3CU.

Consider the graph $y = \left(\frac{1}{3}\right)^x$

Claim: Graph the function $y = \left(\frac{1}{3}\right)^x$ (green curve)

Now, we construct the table for $y = \left(\frac{1}{3}\right)^x$

To substitute different values of x in the original function $y = \left(\frac{1}{3}\right)^x$ to get the different values of y.

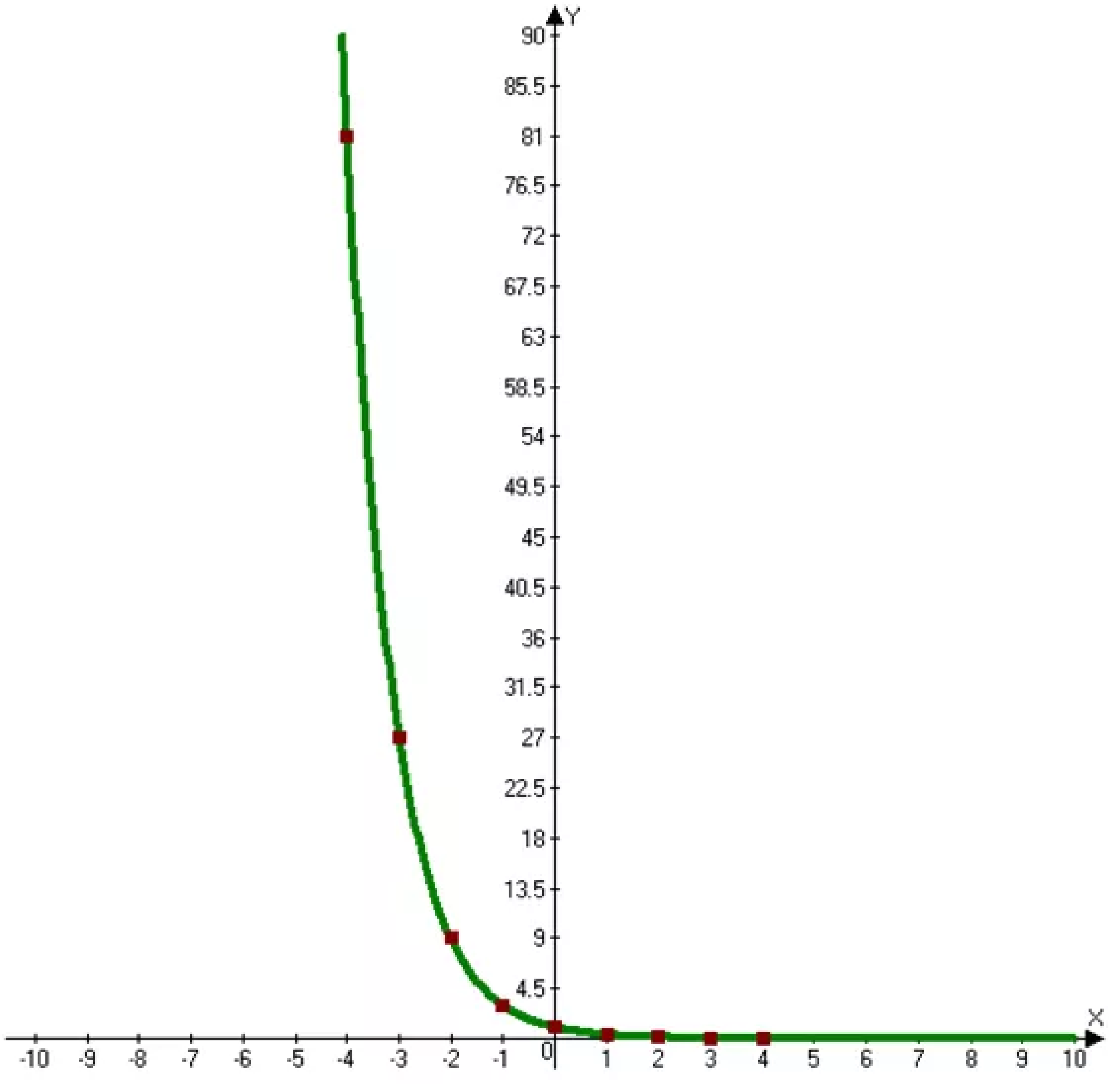
Plotting these all ordered pair and connect them with a smooth curve.

Table for $y = \left(\frac{1}{3}\right)^x$

x	$\left(\frac{1}{3}\right)^x$	y	(x, y)
-4	$\left(\frac{1}{3}\right)^{-4} = 81$	81	$(-4, 81)$
-3	$\left(\frac{1}{3}\right)^{-3} = 27$	27	$(-3, 27)$
-2	$\left(\frac{1}{3}\right)^{-2} = 9$	9	$(-2, 9)$
-1	$\left(\frac{1}{3}\right)^{-1} = 3$	3	$(-1, 3)$
0	$\left(\frac{1}{3}\right)^{0} = 1$	1	$(0, 1)$
1	$\left(\frac{1}{3}\right)^{1} = 0.3$	0.3	$(1, 0.3)$
3	$\left(\frac{1}{3}\right)^{3} = 0.03$	0.03	$(3, 0.03)$
4	$\left(\frac{1}{3}\right)^{4} = 0.012$	0.012	$(4, 0.012)$

Now, add these all ordered pairs (brown dots), to get a smooth curve. We observe that the graph $y=\left(\frac{1}{3}\right)^x$ is decreases as *x* increases. So $\boxed{\text{Kiski}}$ graph *B* correct.

Because Amalia graphing $y=\left(\frac{1}{3}\right)^x$ is decreasing crease as *x* increasing.



Answer 3PQ.

Consider the equation $2v^2 - 4v = 1$

Claim: Solve the equation by quadratics formula.

Step1: Re-write the equation $2v^2 - 4v = 1$ by the standard quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$

$2v^2 - 4v = 1$ (Original equation)

$2v^2 - 4v - 1 = 1 - 1$ (Subtract 1 on both sides)

$2v^2 - 4v - 1 = 0$

Step2: Now solve the equation $2v^2 - 4v = 1$ by quadratic formula

Now, compare the equation $2v^2 - 4v = 1$ with the standard quadratic equation we obtain that $a = 2; b = -4, c = -1$ and $x = v$

Use the formula: "The solution of the quadratic equation $2v^2 - 4v = 1$ where $a \neq 0$ are given by the quadratic form $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ "

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{(Original formula)}$$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(-1)}}{2(2)} \quad \left(\begin{array}{l}\text{Replace } a \text{ by } 2,\ b \text{ by } -4,\ c \text{ by } -1 \\ \text{and } x \text{ by } v\end{array}\right)$$

$$= \frac{-(-4) \pm \sqrt{16+8}}{4}$$

$$= \frac{-(-4) \pm \sqrt{24}}{4}$$

$$\approx \frac{4 \pm 4.89}{4} \quad \left(\sqrt{24} = 4.89\right)$$

$$v \approx \frac{4+4.89}{4} \quad \text{or} \quad v \approx \frac{4-4.89}{4}$$

$$v \approx \frac{8.89}{4} \quad \text{or} \quad v \approx \frac{-0.89}{4}$$

$$v \approx 2.22 \quad \text{or} \quad v \approx -0.22$$

Step3: Check:

Substitute each value of *x* in the original equation $2v^2-4v=1$

$$2v^2-4v=1 \quad \text{(original equation)}$$

$$2(-0.22)^2-4(-0.22)\overset{?}{=}1 \quad \text{(Replace } x \text{ by } -0.22)$$

$$0.9\overset{?}{\approx}1$$

$$1=1 \quad \text{True}$$

$$2v^2-4v=1 \quad \text{(original equation)}$$

$$2(2.22)^2-4(2.22)\overset{?}{=}1 \quad \text{(Replace } x \text{ by } 2.22)$$

$$0.9\overset{?}{\approx}1$$

$$1=1\,\text{True}$$

Therefore $v=-0.22$ and $v=2.2$ satisfies the equation $2v^2-4v=1$

Hence, the solution set is $\boxed{\{-0.22, 2.22\}}$

Answer 4CU.

Consider the function $y=3^x$

Claim: To graph the function $y=3^x$ and use the graph.

Step 1: To determine the approximate value $3^{1.2}$

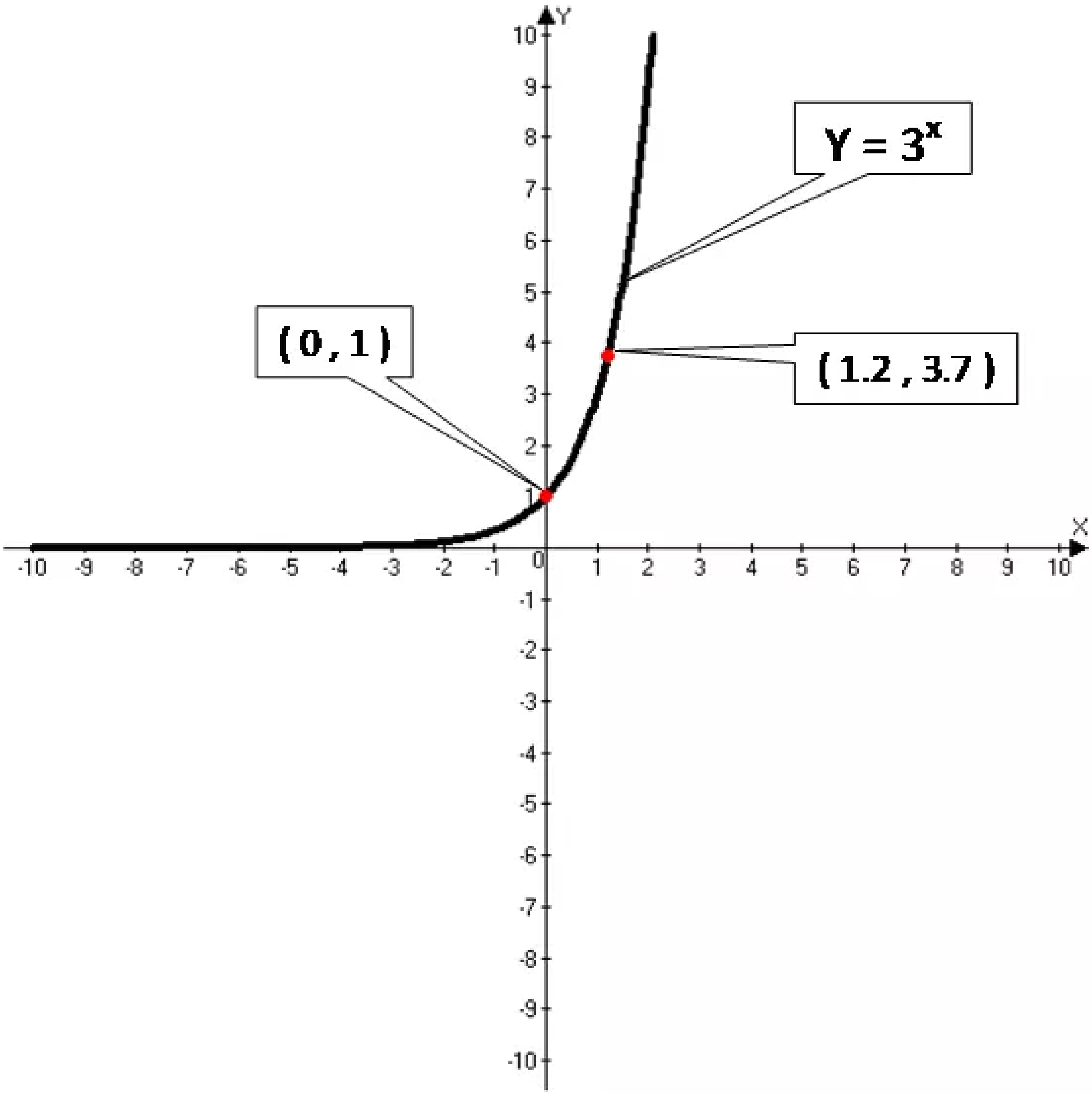
Now, we construct the table for $y=3^x$. To substitute different values of *x* in the original function $y=3^x$ to get the different values of *y*

Plotting these all ordered pair and connect them with a smooth curve.

Table for $y = 3^x$

x	3^x	y	(x, y)
-3	$3^{-3} = \frac{1}{27}$	$\frac{1}{27}$	$\left(-3, \frac{1}{27}\right)$
-2	$3^{-2} = \frac{1}{9}$	$\frac{1}{9}$	$\left(-2, \frac{1}{9}\right)$
-1	$3^{-1} = \frac{1}{3}$	$\frac{1}{3}$	$\left(-1, \frac{1}{3}\right)$
0	$3^0 = 1$	1	$(0,1)$
1	$3^1 = 3$	3	$(1,3)$
2	$3^2 = 9$	9	$(2,9)$
3	$3^3 = 27$	27	$(3,27)$

Now, add these all ordered pairs, to get a smooth curve. The *y* – intercept is $\boxed{1}$



Step 2: use the graph to determine the approximate value of $3^{1.2}$

The graph represents all real values of *x* and their corresponding value of *y* for $y = 3^x$. So, the value of *y* is about 3.5 when $x = 1.2$. Use calculator to confirm this value

$3^{1.2} \approx 3.737192819$

Answer 4PQ.

Consider the function $y = 0.5(4^x)$

Claim: Graph the function $y = 0.5(4^x)$ and to find the y-intercept of the function

$y = 0.5(4^x)$

Step1: Graph the function $y = 0.5(4^x)$

To construct the table for $y = 0.5(4^x)$

Now, substitute the different values of 'x', we obtain the y – values plotting these all ordered pairs and connect them we obtain the smooth curve.

Table for $y = 0.5(4^x)$

x	$0.5(4^x)$	y	(x, y)
-3	$0.5(4^{-3}) = 0.0078$	0.0078	$(-3, 0.0078)$
-2	$0.5(4^{-2}) = 0.031$	0.031	$(-2, 0.031)$
-1	$0.5(4^{-1}) = 0.125$	0.125	$(-1, 0.125)$
0	$0.5(4^0) = 0.5$	0.5	$(0, 0.5)$
1	$0.5(4^1) = 2$	2	$(1, 2)$
2	$0.5(4^2) = 8$	8	$(2, 8)$
3	$0.5(4^3) = 32$	32	$(3, 32)$

Now connect these all ordered pairs we obtain the smooth curve. The curve $y = 0.5(4^x)$ cuts at y – axis (0, 0.5). The y – intercept of the function $y = 0.5(4^x)$ is $\boxed{0.5}$.

Step2: Verification

To find y – intercept of the function $y = 0.5(4^x)$ put x = 0 in the original function $y = 0.5(4^x)$, we obtain the y – intercept.

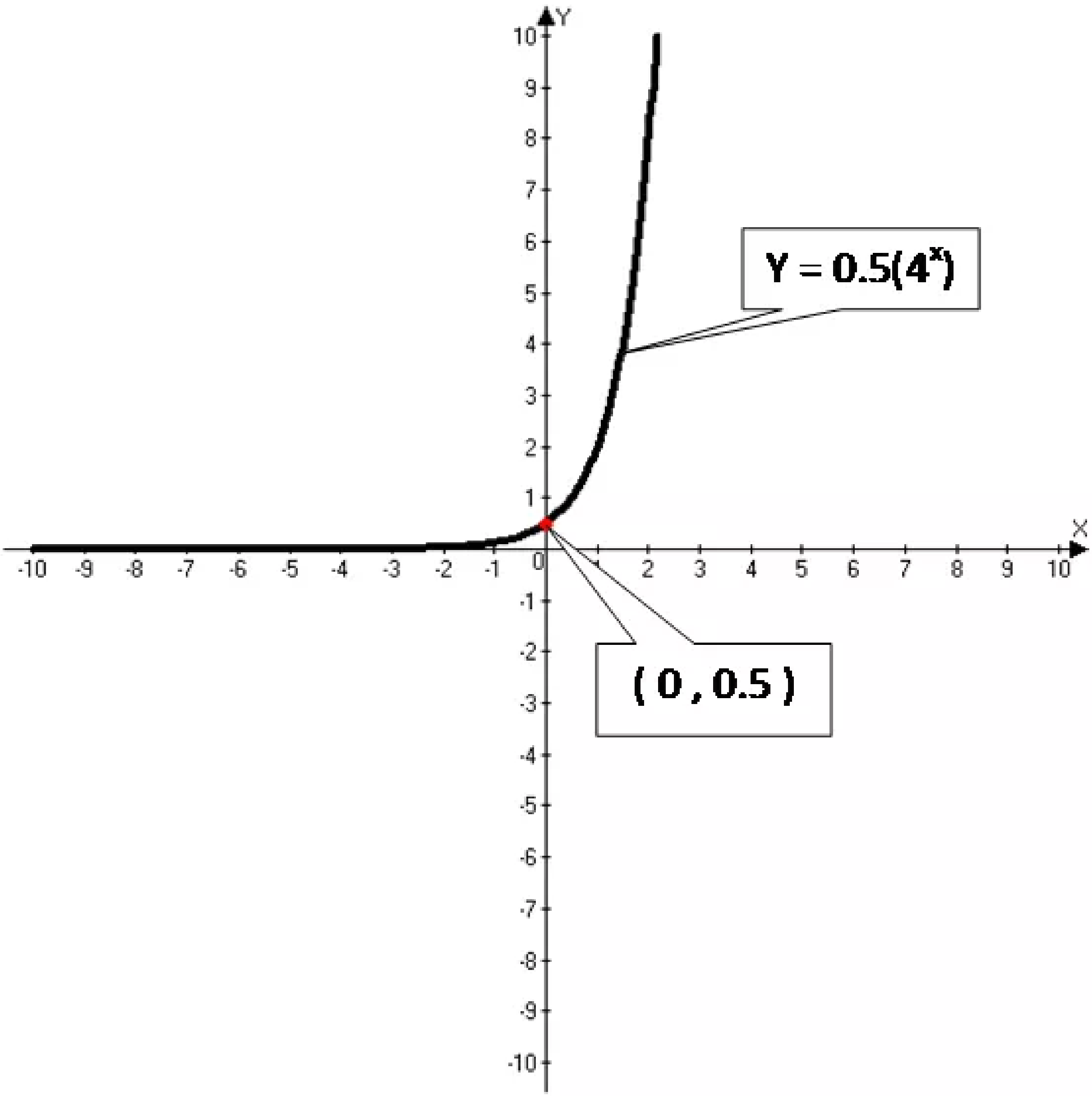
$y = 0.5(4^x)$ (original equation)

$y = 0.5(4^0)$ (Replace x by 0)

$y = 0.5(1)$ (Use the rule $a^0 = 1$ if $a \neq 0$)

$y = 0.5$

Therefore the y – intercept of the function $y = 0.5(4^x)$ is $\boxed{0.5}$



Y
X
Y = 0.5(4^x)
(0 , 0.5)

Answer 5CU.

Consider the function $y=\left(\frac{1}{4}\right)^x$

Claim: To graph the function $y=\left(\frac{1}{4}\right)^x$ and use the graph to determine the approximate value of $\left(\frac{1}{4}\right)^{1.7}$

Step 1: Graph the function $y=\left(\frac{1}{4}\right)^x$

Now, we construct the table for $y=\left(\frac{1}{4}\right)^x$.

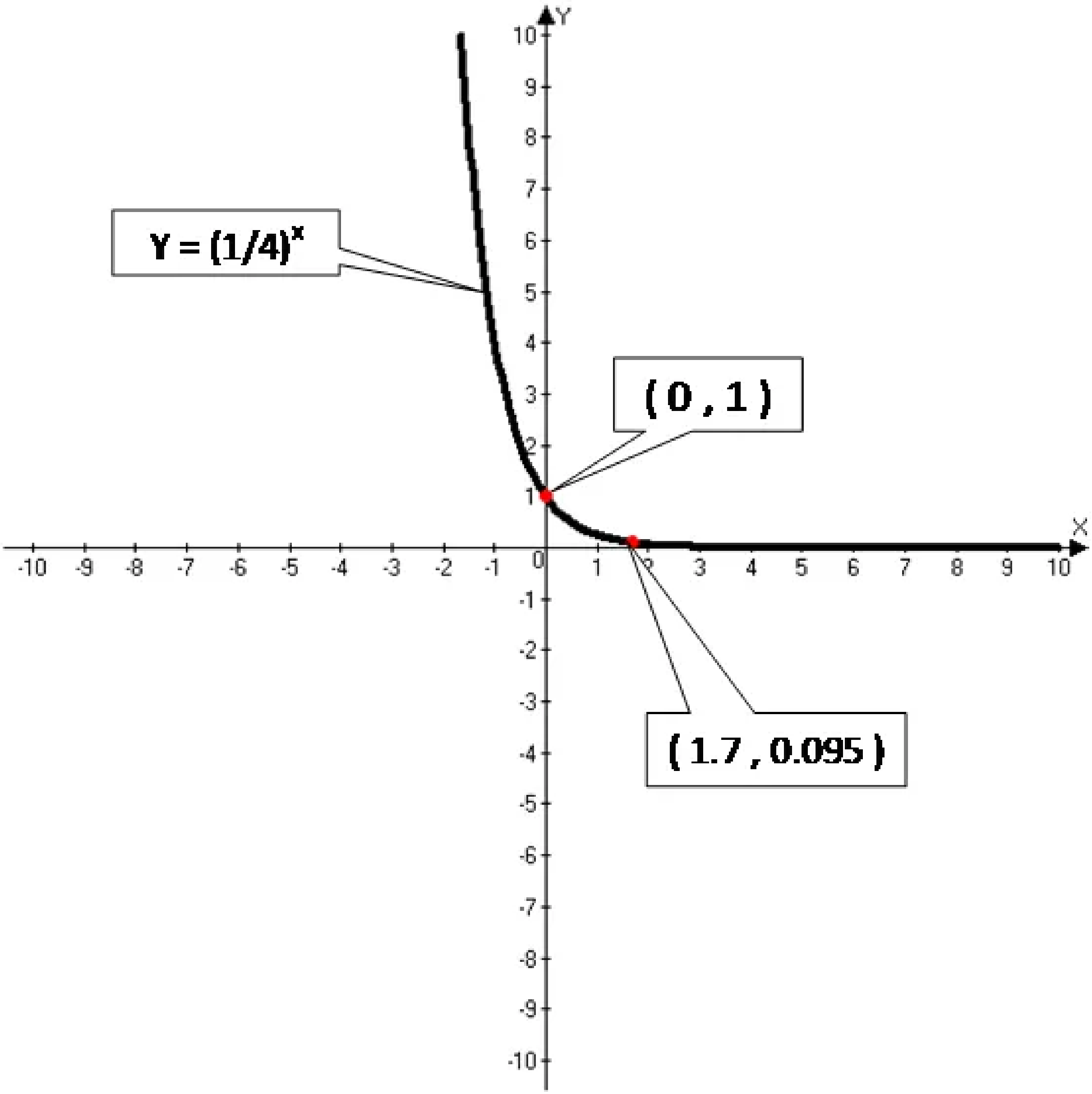
To substitute different values of *x* in the original function $y=\left(\frac{1}{4}\right)^x$ to get the different values of *y*

Plotting these all ordered pair and connect them with a smooth curve.

Table for $y=\left(\frac{1}{4}\right)^x$

x	$\left(\frac{1}{4}\right)^x$	y	(x, y)
-3	$\left(\frac{1}{4}\right)^{-3} = 64$	64	$(-3, 64)$
-2	$\left(\frac{1}{4}\right)^{-2} = 16$	16	$(-2, 16)$
-1	$\left(\frac{1}{4}\right)^{-1} = 4$	4	$(-1, 4)$
0	$\left(\frac{1}{4}\right)^{0} = 1$	1	$(0, 1)$
1	$\left(\frac{1}{4}\right)^{1} = 0.25$	0.25	$(1, 0.25)$
2	$\left(\frac{1}{4}\right)^{2} = 0.0625$	0.0625	$(2, 0.0625)$
3	$\left(\frac{1}{4}\right)^{3} = 0.0156$	0.0156	$(3, 0.0156)$

Now, add these all ordered pairs, to get a smooth curve. The *y* – intercept is $\boxed{1}$



Step 2: use the graph to determine the approximate value of $\left(\frac{1}{4}\right)^{1.7}$

The graph represents all real values of *x* and their corresponding value of $y = \left(\frac{1}{4}\right)^x$.

So the value of $y = 0.094$. When $x = 1.7$. Use the calculator to confirm $\left(\frac{1}{4}\right)^{1.7} \approx 0.094732$

Answer 5PQ.

Consider the function $y = 5^x - 4$

Claim: Graph the function $y = 5^x - 4$ and to find the *y*-intercept of the function

$y = 5^x - 4$

Step1: Graph the function $y = 5^x - 4$

To construct the table for $y = 5^x - 4$

Now, substitute the different values of '*x*', we obtain the *y* – values plotting these all ordered pairs and connect them we obtain the smooth curve.

Table for $y = 5^x - 4$

x	$5^x - 4$	y	(x, y)
-3	$5^{-3} - 4 = -3.992$	-3.992	$(-3, -3.992)$
-2	$5^{-2} - 4 = -3.96$	-3.96	$(-2, -3.96)$
-1	$5^{-1} - 4 = -3.8$	-3.8	$(-1, -3.8)$
0	$5^0 - 4 = -3$	-3	$(0, -3)$
1	$5^1 - 4 = 1$	1	$(1, 1)$
2	$5^2 - 4 = 21$	21	$(2, 21)$
3	$5^3 - 4 = 121$	121	$(3, 121)$

Now connect these all ordered pairs we obtain the smooth curve. The curve $y = 5^x - 4$ cuts at *y* – axis -3. The *y* – intercept of the function $y = 5^x - 4$ is $\boxed{-3}$.

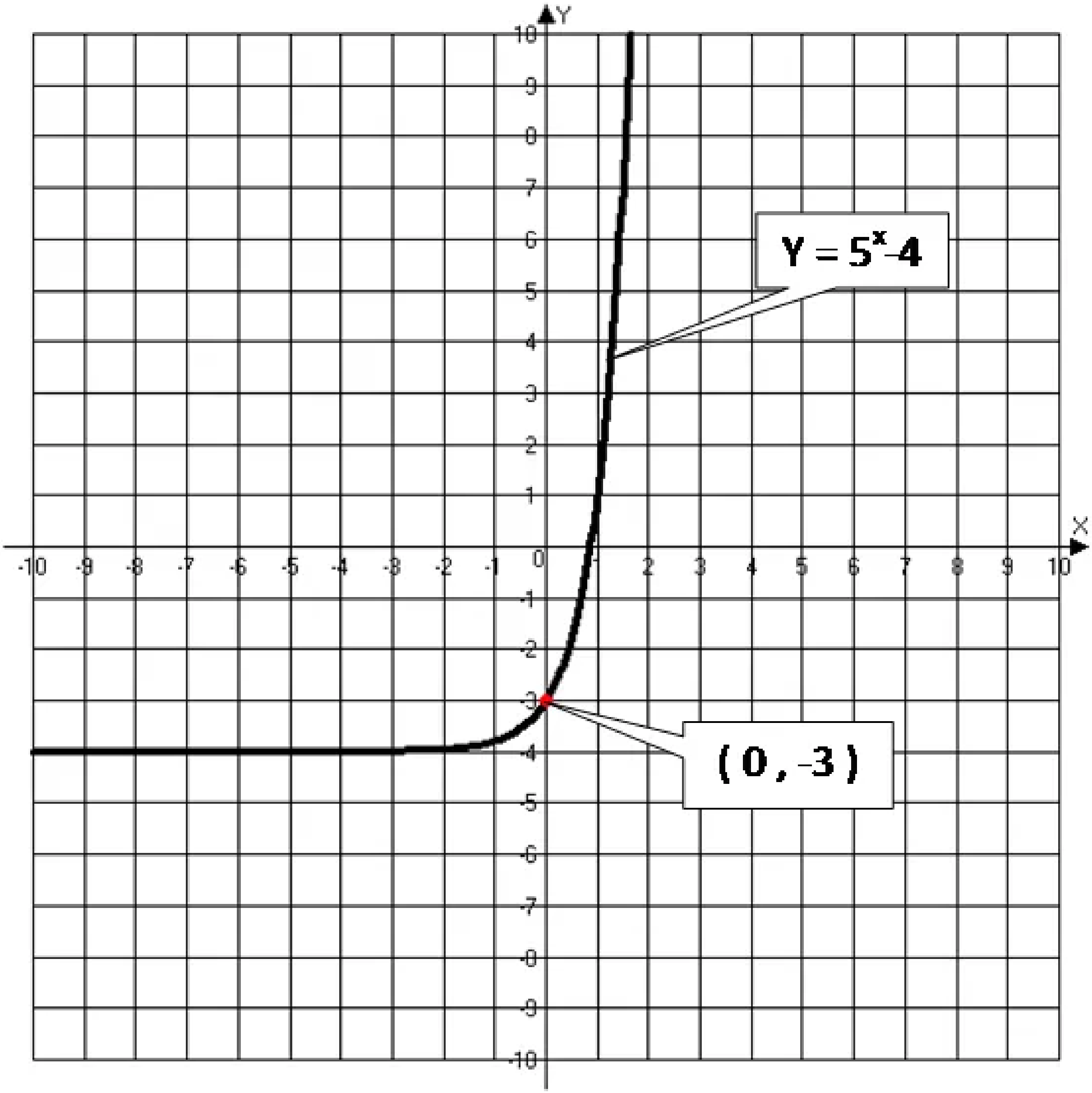
Step2: Verification

To find *y* – intercept of the function $y = 5^x - 4$ put *x* = 0 in the original function $y = 5^x - 4$, we obtain the *y* – intercept.

$$
\begin{aligned}
y &= 5^x - 4 && (\text{original equation}) \\
y &= 5^0 - 4 && (\text{Replace } x \text{ by } 0) \\
y &= 1 - 4 && (\text{Use the rule } a^0 = 1 \text{ if } a \neq 0) \\
y &= -3
\end{aligned}
$$

Therefore the curve $y = 5^x - 4$ cuts at *y* – axis is $(0, -3)$

Hence, the *y* – intercept of the function $y = 5^x - 4$ is $\boxed{-3}$


Y
X
Y = 5^x-4
(0 , -3)

Answer 6CU.

Consider the function $y = 9^x$

Claim: To graph the function $y = 9^x$ and use the graph to determine the approximate value of $9^{0.8}$

Step 1: Graph the function $y = 9^x$

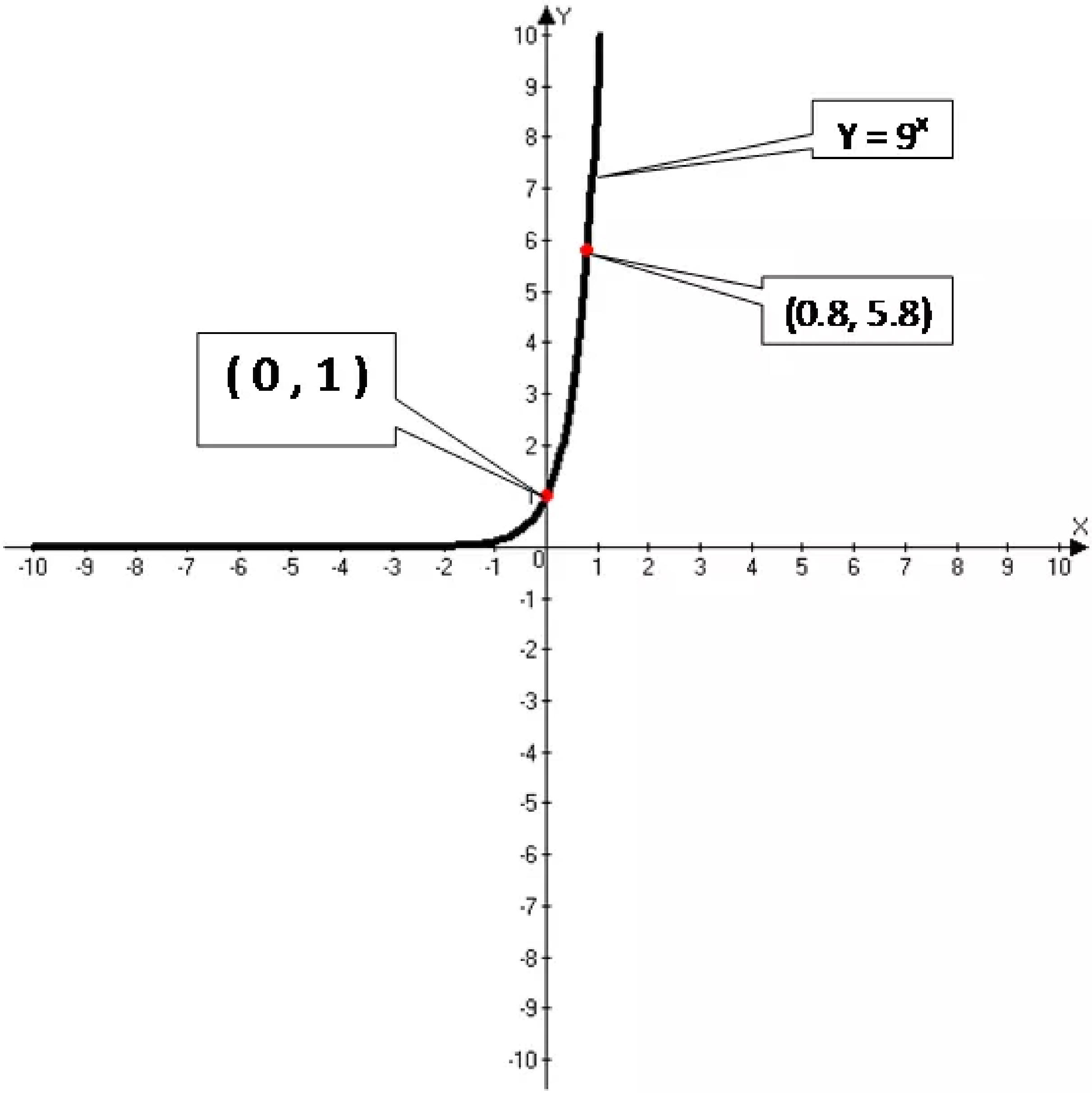
Now, we construct the table for $y = 9^x$.

To substitute different values of *x* in the original function $y = 9^x$ to get the different values of *y*

Plotting these all ordered pair and connect them with a smooth curve.

x	9^x	y	(x, y)
-3	$9^{-3} = \frac{1}{9^3}$	0.00137	$(-3, 0.00137)$
-2	$9^{-2} = \frac{1}{9^2}$	0.01234	$(-2, 0.01234)$
-1	$9^{-1} = \frac{1}{9}$	0.1	$(-1, 0.1)$
0	$9^0 = 1$	1	$(0, 1)$
1	$9^1 = 9$	9	$(1, 9)$
2	$9^2 = 81$	81	$(2, 81)$

Now, add these all ordered pairs, to get a smooth curve. The *y* – intercept is $\boxed{1}$



Step 2: use the graph to determine the approximate value of $9^{0.8}$

The graph represents all real values of *x* and their corresponding value of *y* for $y = 9^x$. So the value of $y = 5.7$ use a calculator to conform this value

$9^{0.8} \approx 5.799546135$

Answer 7CU.

Consider the function $y = 2 \cdot 3^x$

Claim: Graph the function $y = 2 \cdot 3^x$ and to find the *y*-intercept of $y = 2 \cdot 3^x$

Step1: Graph the function $y = 2 \cdot 3^x$

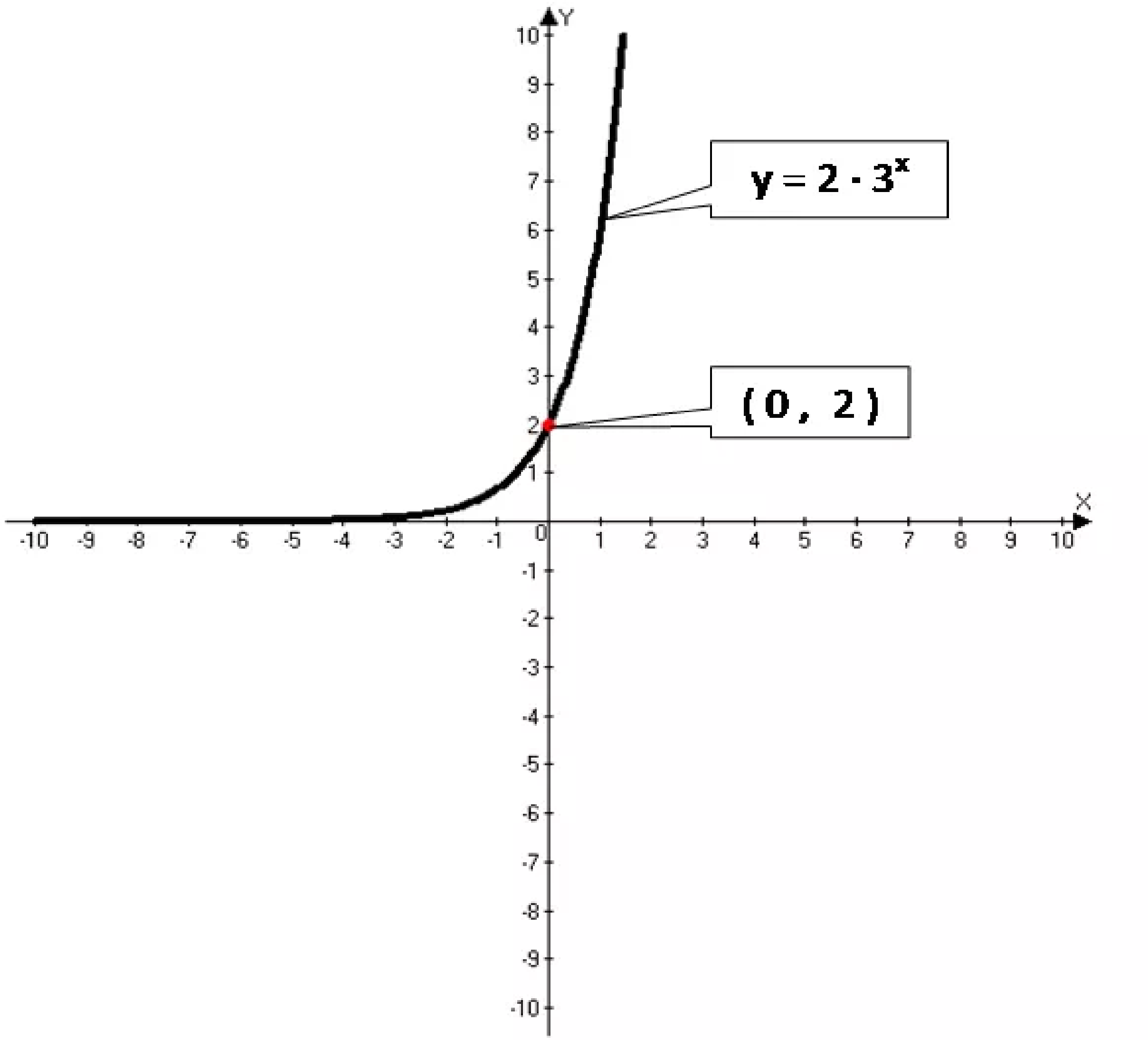
To construct the table for $y = 2 \cdot 3^x$

Now, substitute the different values of 'x' in the original function $y = 2 \cdot 3^x$, we obtain the *y* – values plotting these all ordered pairs and connect them we obtain the smooth curve.

Table for $y = 2 \cdot 3^x$

x	$2 \cdot 3^x$	y	(x, y)
−3	$2.3^{-3} = 0.074$	0.074	$(-3, 0.074)$
−2	$2.3^{-2} = 0.22$	0.22	$(-2, 0.22)$
−1	$2.3^{-1} = 0.66$	0.66	$(-1, 0.66)$
0	$2.3^{0} = 2$	2	$(0, 2)$
1	$2.3^{1} = 6$	6	$(1, 6)$
2	$2.3^{2} = 18$	18	$(2, 18)$
3	$2.3^{3} = 54$	54	$(3, 54)$

Now connect these all ordered pairs we obtain the smooth curve. The curve $y = 2 \cdot 3^x$ cuts at *y* – axis is $(0,2)$. The *y* – intercept of the function $y = 2 \cdot 3^x$ is $\boxed{2}$.



<u>Step2</u>: Verification

To find *y* – intercept of the function $y = 2 \cdot 3^x$ put *x* = 0 in the original function $y = 2 \cdot 3^x$, we obtain the *y* – intercept.

$y = 2 \cdot 3^x$ (original equation)

$y = 2 \cdot 3^0$ (Replace x by 0)

$y = 2 \cdot 1$ (Use the rule $a^0 = 1$ if $a \neq 0$)

$y = 2$

Therefore the curve $y = 2 \cdot 3^x$ cuts at *y* – axis is $(0,2)$

Hence, the *y* – intercept of the function $y = 2 \cdot 3^x$ is $\boxed{2}$

Answer 8CU.

Consider the function $y=4\left(5^x-10\right)$

Claim: Graph the function $y=4\left(5^x-10\right)$ and to find the *y*-intercept of $y=4\left(5^x-10\right)$

Step1: Graph the function $y=4\left(5^x-10\right)$

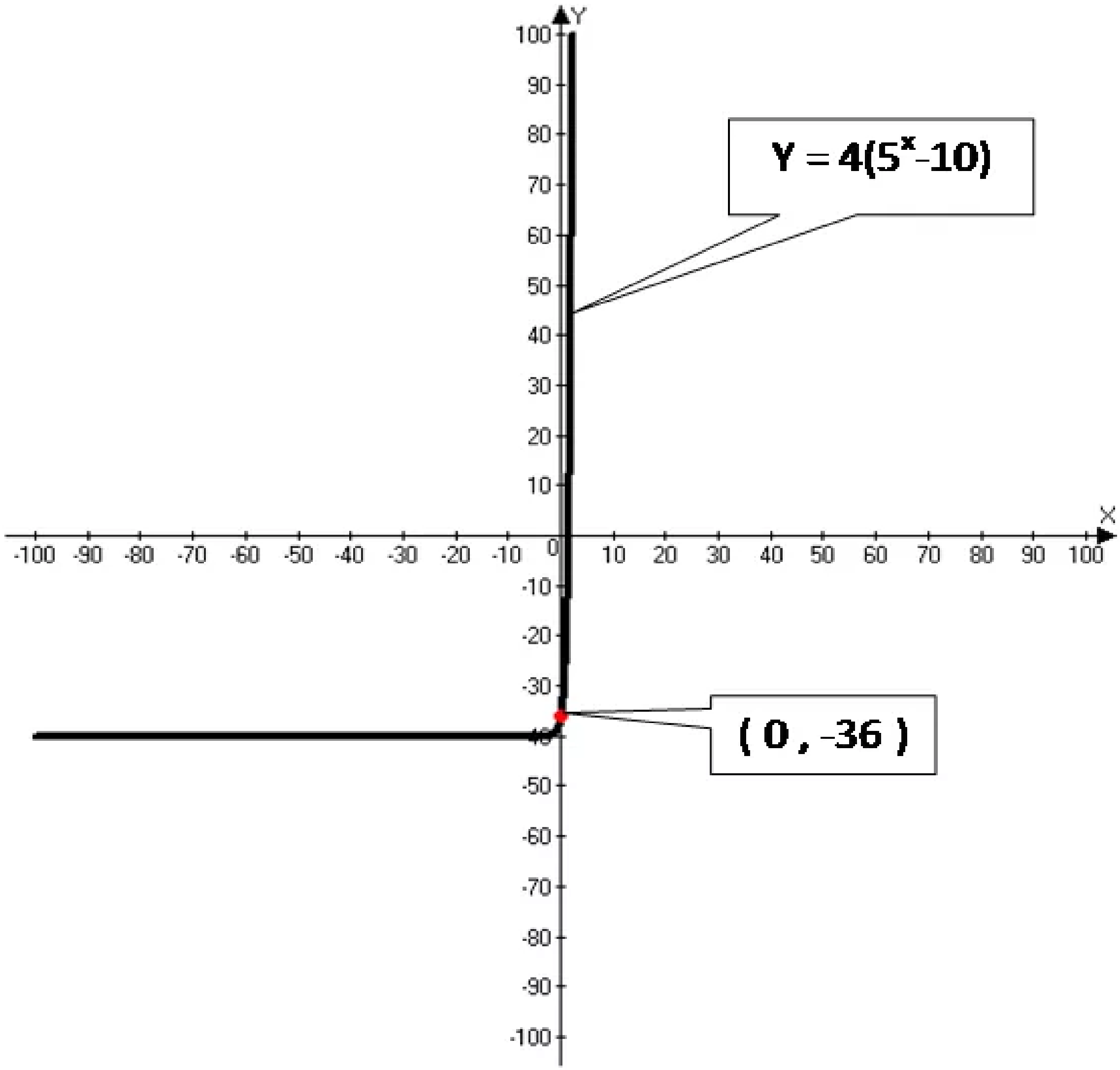
To construct the table for $y=4\left(5^x-10\right)$

Now, substitute the different values of '*x*' in the original function $y=4\left(5^x-10\right)$, we obtain the *y* – values plotting these all ordered pairs and connect them we obtain the smooth curve.

Table for $y=4\left(5^x-10\right)$

x	$4\left(5^x-10\right)$	y	(x,y)
−3	$4\left(5^{-3}-10\right)=-39.968$	−39.968	$(-3,-39.968)$
−2	$4\left(5^{-2}-10\right)=-39.84$	−39.84	$(-2,-39.84)$
−1	$4\left(5^{-1}-10\right)=-39.2$	−39.2	$(-1,-39.2)$
0	$4\left(5^{0}-10\right)=-36$	−36	$(0,-36)$
1	$4\left(5^{1}-10\right)=-20$	−20	$(1,-20)$
2	$4\left(5^{2}-10\right)=60$	60	$(2,60)$

Now connect these all ordered pairs we obtain the smooth curve. The curve $y = 4(5^x - 10)$ cuts at y – axis is $(0, -36)$. The y – intercept of the function $y = 4(5^x - 10)$ is $\boxed{-36}$.



Step2: Verification

To find y – intercept of the function $y = 4(5^x - 10)$ put $x = 0$ in the original function $y = 4(5^x - 10)$, we obtain the y – intercept.

$y = 4(5^x - 10)$ (original equation)

$y = 4(5^0 - 10)$ (Replace x by 0)

$y = 4(1 - 10)$ (Use the rule $a^0 = 1$ if $a \neq 0$)

$y = 4(-9)$

$y = -36$

Therefore the curve $y = 4(5^x - 10)$ cuts at y – axis is $(0, -36)$

Hence, the y – intercept of the function $y = 4(5^x - 10)$ is $\boxed{-36}$

Answer 9CU.

Consider the data

x	0	1	2	3	4	5
y	1	6	36	216	1296	7776

Step1: look for a Determine the pattern.

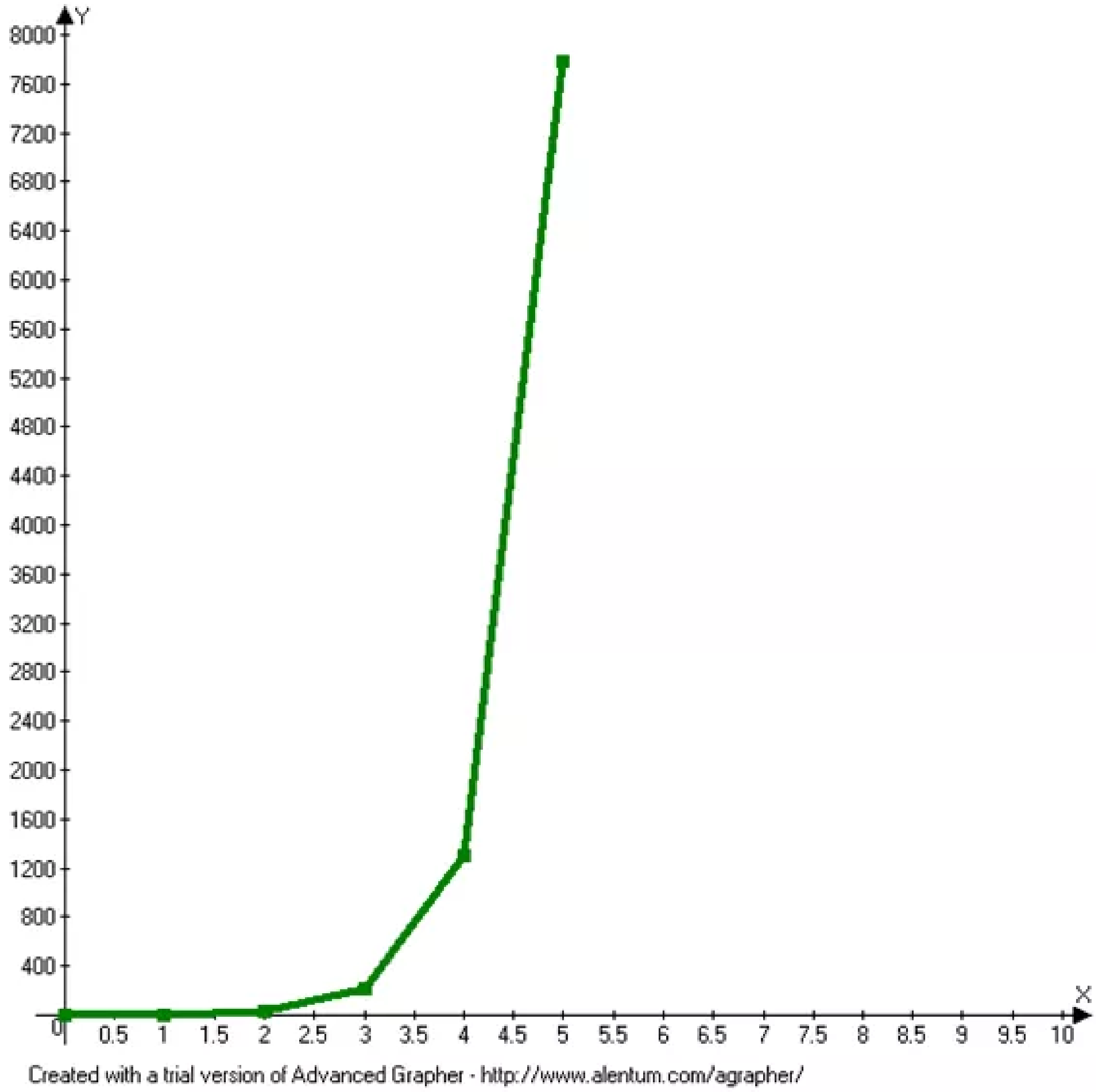
The domain values are at regular interval of '1' let's see. If there is a common factor among the range values,

1 6 36 216 1296 7776

$\times 6$ $\times 6$ $\times 6$ $\times 6$ $\times 6$

Hence, yes the domain vales are at regular interval and the range values have a common factor '6' the data are probably exponential. The equation for the data involve $\boxed{6^x}$

Step2:



We observe that, the graph shows rapidly decreasing values of if as a increases. This is a characteristic of exponential behavior.

Answer 10CU.

Consider the following data

x	4	6	8	10	12	14
y	5	9	13	17	21	25

Step1: Look for a pattern.

The domain values are at regular interval of '2' . The range values have a common difference 6

5 9 13 17 21 25

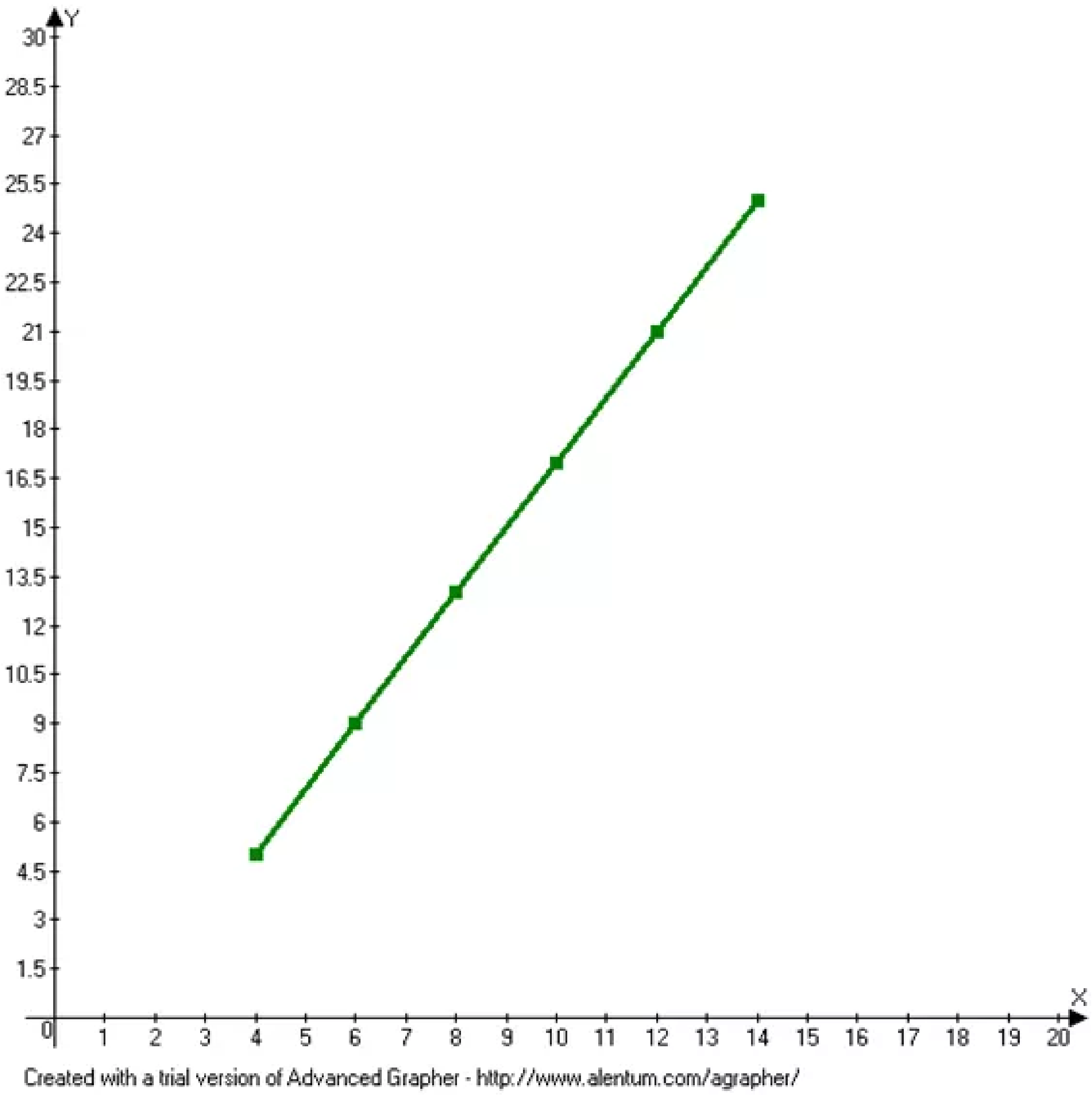
+4 +4 +4 +4 +4

Therefore, the data do not display exponential behavior, but rather linear behavior.

Hence, not the domain vales are at regular interval and the range values have a common difference $\boxed{6}$

Step2:

x	4	6	8	10	12	14
y	5	9	13	17	21	25



We observe that, this is a graph of line not an exponential function.

Answer 11CU.

Consider, a wise man asked his rules to provide rice for feeding his people. Rather than receiving a constant daily supply of rice, the wise man asked the rules to given him.

2 grains rice for the first square on a chess board, 4 grains for the second on a chess board, 8 grains for the third, 16 for the fourth and so on doubling the amount of rice with each square of the board.

Claim: To construct the table

Since 2 grains rice for the first square on the board

4 grains rice for the second square on the board

8 grains rice for the third square on the board

16 grains rice for the fourth square on the board

Board at *x*: represents the rice on a chess board

y: represents the rice on a chess board

x	1	2	3	4
y	2	4	8	16

Step2: To find the equation for the data.

The domain values are at regular intervals of 1 let's see if there is a common factor among the range values.

2 4 8 16

$\times 2$ $\times 2$ $\times 2$

Therefore, the domain values at regular intervals and the range values have a common factor 2.

Hence, the data probably exponential, the equation for the data may involve $\boxed{y = 2^x}$

Step3: To find the how many grains of rice will the wise man receive for the last (64) square on the chess board.

Substitute x = 64 in the original function

$y = 2^x$ we get the grains of rice on a chess board.

$$y = 2^x \qquad \text{(original function)}$$
$$y = 2^{64} \qquad (\text{Replace } x \text{ by } 64)$$
$$y = 1.84 \times 10^{19}$$

Hence, $\boxed{1.84 \times 10^{19}}$ grains of rice will the wise man receive for the last 64th square on chess board.

Answer 12CU.

Consider one pound of rice contains 24000 grains (approximate)

One tone = 2000 pounds

Per a ton number of rice grains $= 2000 \times 24000$

$= 48,000,000$

According to the problems wise man asked the emperor

For 1st square on chess board 21= 2 grains

For 2nd square on chess board 22= 4 grains

" " " " " "

" " " " " "

" " " " " "

For 64th square on chess board 264 $= 1.844674407 \times 10^{19}$ grains

Since chess board contains 64 squares

We can write the grains per a square $\boxed{y = 2^x}$ exponential

Graph we can draw the table for the function

Table:

$x =$ square number	$y =$ number of grains in the square $= 2^x$	(x, y)
1	$2^1 = 2$	$(1,2)$
2	$2^2 = 4$	$(2,4)$
3	$2^3 = 8$	$(3,8)$
4	$2^4 = 16$	$(4,16)$
5	$2^5 = 32$	$(5,32)$
.....	.....	
.....	.....	
.....	.....	
64	$2^{64} = 1.844674407 \times 10^{19}$	

The last night the wise man received the rice

$$= 2 + 2^2 + 2^3 + 2^4 + ... + 2^{64} = s^{64}$$

It is in G.P with a = 2; r = 2

$$s_n = \frac{a(r^n - 1)}{r - 1}$$

$$s_{64} = \frac{2(2^{64} - 1)}{2 - 1}$$

$$= 2(2^{64} - 1)$$

$$= 2^{65} - 2$$

$$= 3.689348815 \times 10^{19} \text{ grains}$$

$$= \frac{3.689348815 \times 10^{19}}{48,000,000} \text{tons as per ton 48,000,000 tons}$$

$$= \boxed{7.6816143365 \times 10^{11} \text{ tons}}$$

The wise man received the rice $7.6816143365 \times 10^{11}$ tons from the emperor.

Answer 13PA.

Consider the function $y = 5^x$

Claim: To graph the function $y = 5^x$ and use the graph to determine the approximate value of $5^{1.1}$

Step 1: Graph the function $y = 5^x$

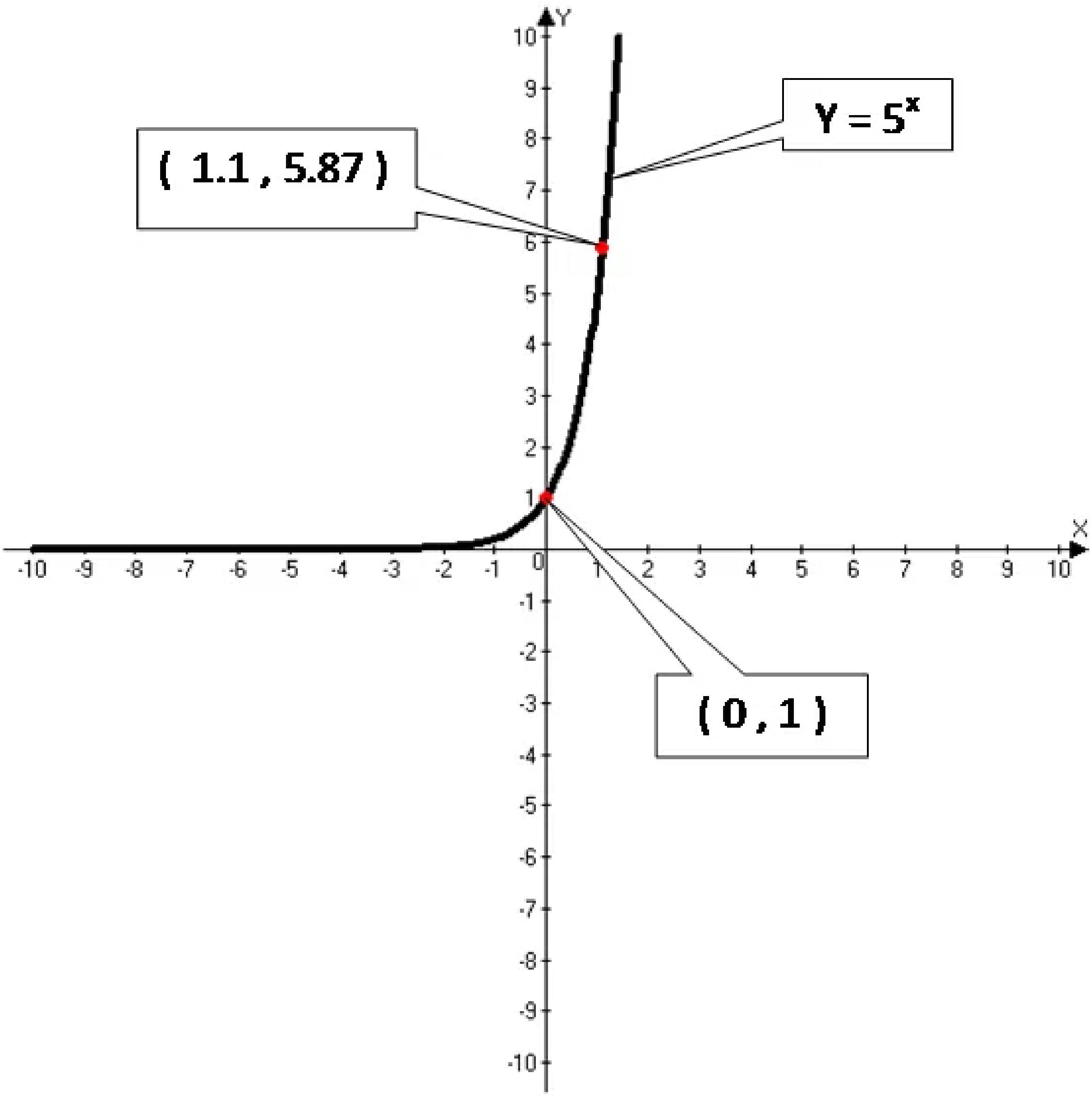
Now, we construct the table for $y = 5^x$.

To substitute different values of *x* in the original function $y = 5^x$. To obtain the different values of *y*. plotting these ordered pairs and connected them with a smooth curve.

Table for $y = 5^x$

x	5^x	y	(x, y)
-3	$5^{-3} = \frac{1}{5^3}$	0.008	$(-3, 0.008)$
-2	$5^{-2} = \frac{1}{5^2}$	0.04	$(-2, 0.04)$
-1	$5^{-1} = \frac{1}{5}$	0.2	$(-1, 0.2)$
0	$5^0 = 1$	1	$(0, 1)$
1	$5^1 = 5$	5	$(1, 5)$
2	$5^2 = 25$	25	$(2, 25)$
3	$5^3 = 125$	125	$(3, 125)$

Now, add these all ordered pairs, to get a smooth curve. The *y* – intercept is $\boxed{1}$



Step 2: The graph represents all real values of *x* and their corresponding values of *y* for $y = 5^x$. So, the value of *y* is about 5.87. use a calculator to confirm this value.

$5^{1.1} \approx 5.873094715$

Answer 14PA.

Consider the function $y = 10^x$

Claim: To graph the function $y = 10^x$ and use the graph to determine the approximate value of $5^{1.1}$

Step 1: Graph the function $y = 10^x$

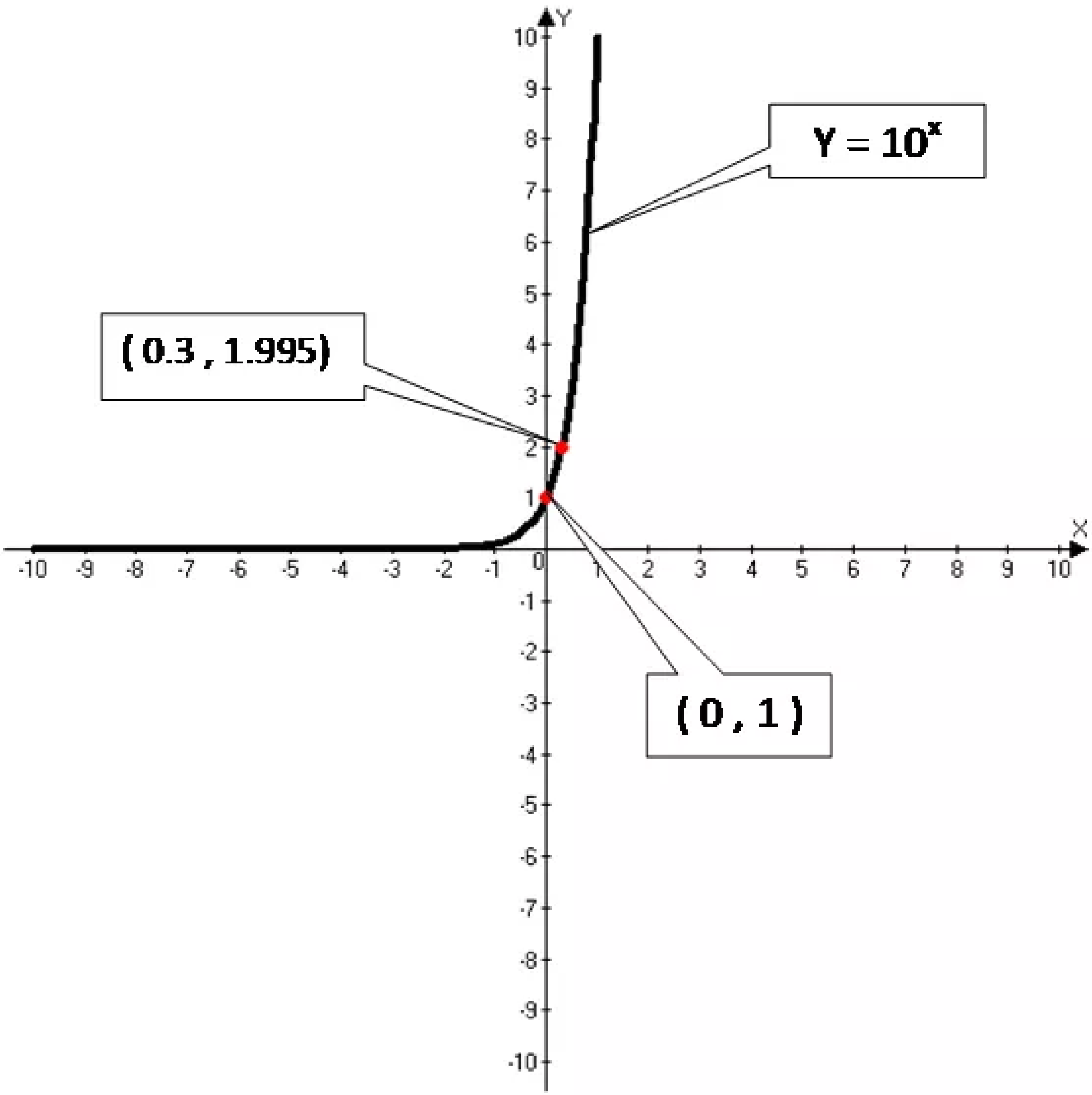
Now, we construct the table for $y = 10^x$.

To substitute different values of *x* in the original function $y = 10^x$. To obtain the different values of *y*. plotting these ordered pairs and connected them with a smooth curve.

Table for $y = 10^x$

x	10^x	y	(x, y)
-3	$10^{-3} = \frac{1}{10^3}$	0.001	$(-3, 0.001)$
-2	$10^{-2} = \frac{1}{10^2}$	0.01	$(-2, 0.01)$
-1	$10^{-1} = \frac{1}{10^1}$	0.1	$(-1, 0.1)$
0	$10^0 = 1$	1	$(0, 1)$
1	$10^1 = 10$	10	$(1, 10)$
2	$10^2 = 100$	100	$(2, 100)$
3	$10^3 = 1000$	1000	$(3, 1000)$

Now, add these all ordered pairs, to get a smooth curve. The *y* – intercept is $\boxed{1}$



Step 2: To determine the approximate value of $10^{0.3}$

The graph represents all real values of *x* and their corresponding values of *y* for $y = 10^x$. So, the value of *y* is 1.995 use a calculator to confirm this value.

$10^{0.3} \approx 2$

Answer 15PA.

Consider the function $y = \left(\frac{1}{10}\right)^x$

Claim: To graph the function $y = \left(\frac{1}{10}\right)^x$ and use the graph to determine the approximate value of $5^{1.1}$

Step 1: Graph the function $y = \left(\frac{1}{10}\right)^x$

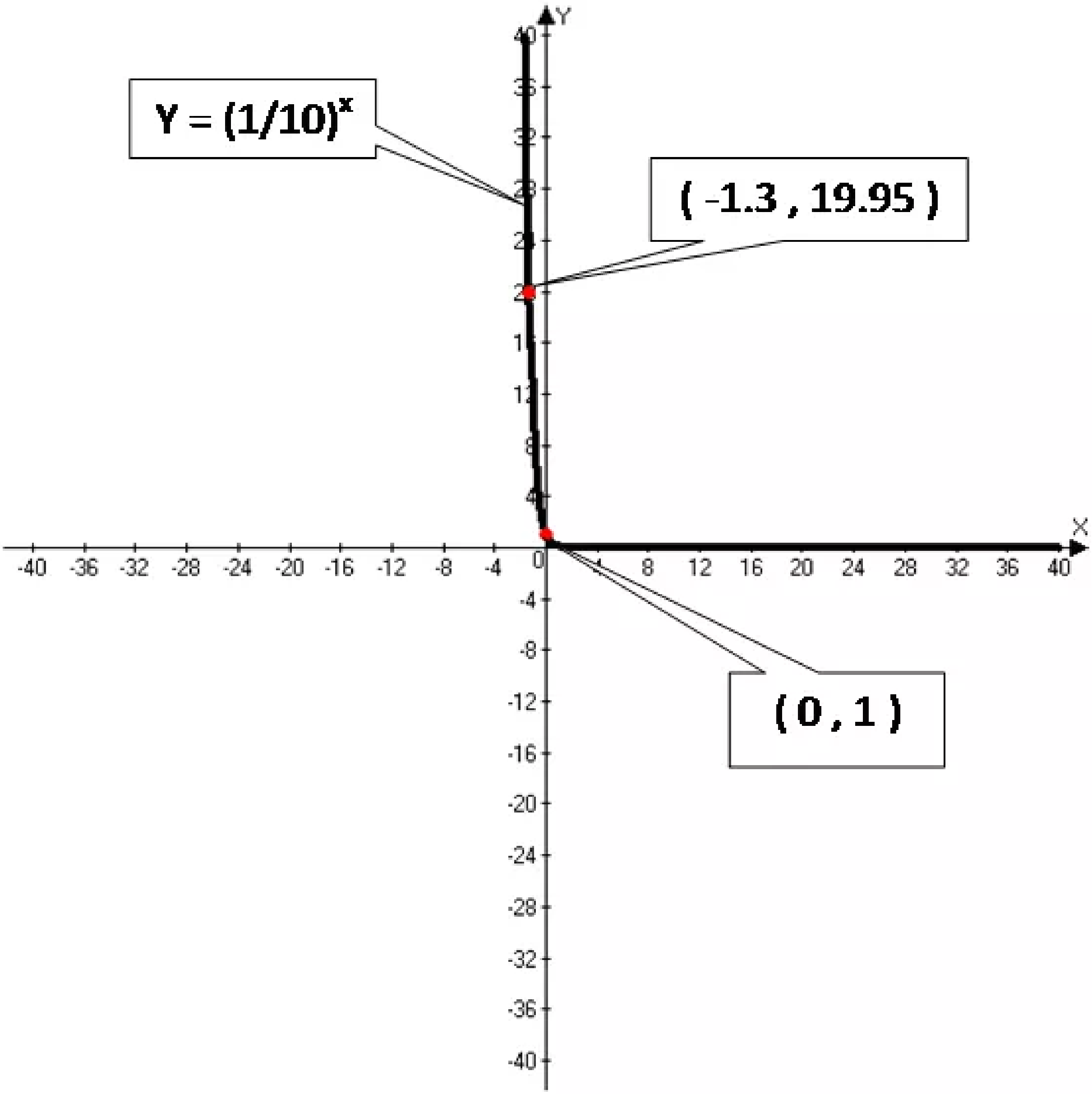
Now, we construct the table for $y = \left(\frac{1}{10}\right)^x$.

To substitute different values of *x* in the original function $y = \left(\frac{1}{10}\right)^x$. To obtain the different values of *y*. plotting these ordered pairs and connected them with a smooth curve.

Table for $y = \left(\frac{1}{10}\right)^x$

x	$\left(\frac{1}{10}\right)^x$	y	(x,y)
-3	$\left(\frac{1}{10}\right)^{-3}$	1000	$(-3,1000)$
-2	$\left(\frac{1}{10}\right)^{-2}$	100	$(-2,100)$
-1	$\left(\frac{1}{10}\right)^{-1}$	10	$(-1,10)$
0	$\left(\frac{1}{10}\right)^{0}$	1	$(0,1)$
1	$\left(\frac{1}{10}\right)^{1}$	0.1	$(1,0.1)$
2	$\left(\frac{1}{10}\right)^{2}$	0.01	$(2,0.01)$
3	$\left(\frac{1}{10}\right)^{3}$	0.001	$(3,0.001)$

Now, add these all ordered pairs, to get a smooth curve. The y – intercept is $\boxed{1}$



Step 2: Use the graph to determine the approximate value of $\left(\frac{1}{10}\right)^{-1.3}$

The graph represents all real value of *x* and their corresponding values of *y* for $y = \left(\frac{1}{10}\right)^{x}$. So the value of *y* is about 20. Use a calculator to confirm this value.

$$\left(\frac{1}{10}\right)^{-1.3} = 19.95262315$$

Answer 16PA.

Consider the function $y = f(x) = \left(\frac{1}{5}\right)^x; \left(\frac{1}{5}\right)^{0.5}$

Claim: Graph the function $y = f(x) = \left(\frac{1}{5}\right)^x$ and to find y – intercept.

Step1: Graph the function $y = f(x) = \left(\frac{1}{5}\right)^x$

Now construct table for $y = \left(\frac{1}{5}\right)^x$.

To substitute different values of x in the original equation $y = \left(\frac{1}{5}\right)^x$.

We obtain y- values. Plotting the this ordered all pairs and connected them. We get a smooth curve.

Table for $y = \left(\frac{1}{5}\right)^x$

x	y
−3	$\left(\frac{1}{5}\right)^{-3} = 125$
−2	$\left(\frac{1}{5}\right)^{-2} = 25$
−1	$\left(\frac{1}{5}\right)^{-1} = 5$
0	$\left(\frac{1}{5}\right)^{0} = 1$
0.5	$\left(\frac{1}{5}\right)^{0.5} = 0.45$

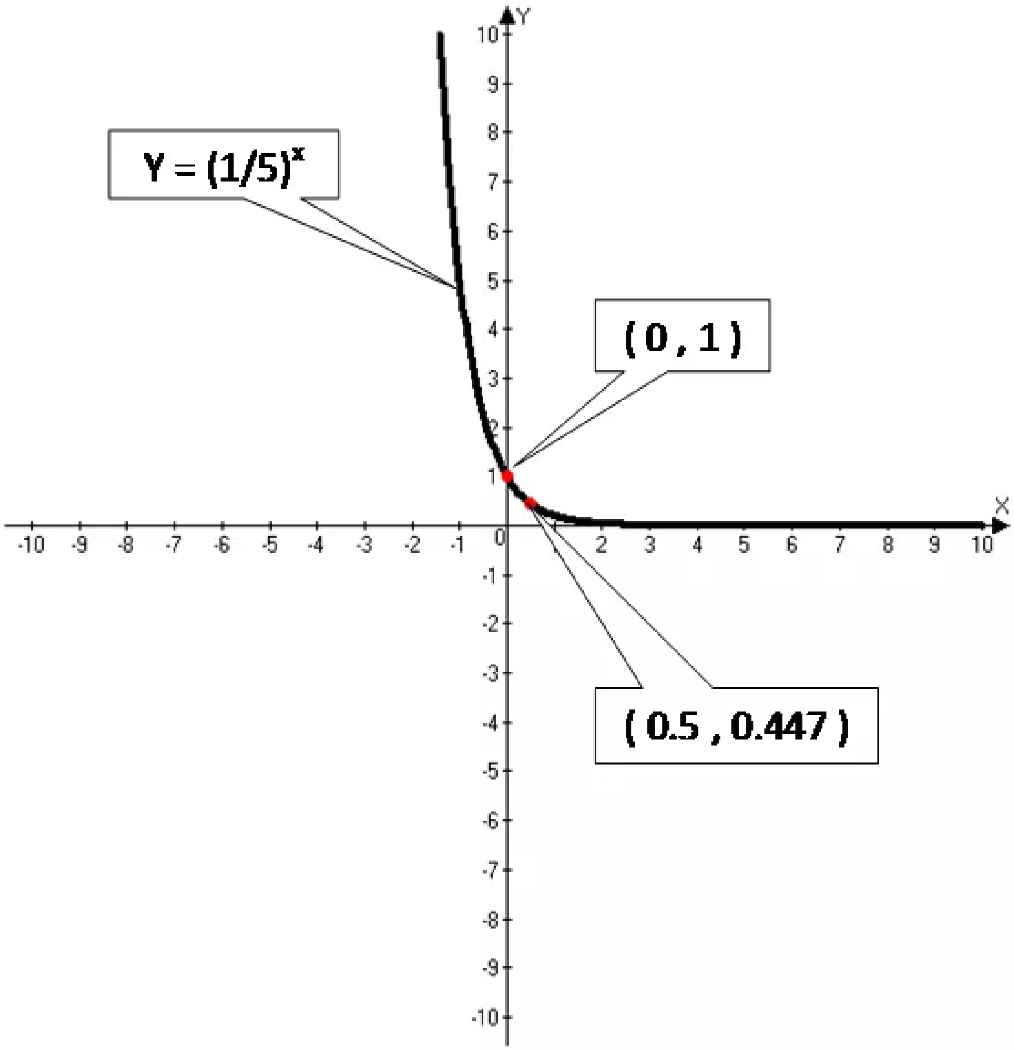
1	$\left(\frac{1}{5}\right)^1 = 0.2$
2	$\left(\frac{1}{5}\right)^2 = 0.04$
3	$\left(\frac{1}{5}\right)^3 = 0.008$

Now, connected all ordered pairs we obtain a smooth curve and the curve $y = \left(\frac{1}{5}\right)^x$ is cut at y – axis is (0, 1).

Therefore y – intercept of the graph $y = \left(\frac{1}{5}\right)^x$ is $\boxed{1}$

By the graph the value of $\left(\frac{1}{5}\right)^{0.5}$ is $\boxed{0.45}$

Step2: to find the value of $\left(\frac{1}{5}\right)^{0.5}$ by using calculator $\left(\frac{1}{5}\right)^{0.5} = \boxed{0.4472}$



Answer 17PA.

Consider the function $y = f(x) = 6^x; 6^{0.3}$

Claim: Graph the function $y = f(x) = 6^x$ and to find y – intercept.

Step1: Graph the function $y = f(x) = 6^x$

Now construct table for $y = 6^x$. To substitute different values of x in the original equation $y = 6^x$, we obtain y- values. Plotting the this ordered all pairs and connected them. We get a smooth curve.

Table for $y = 6^x$

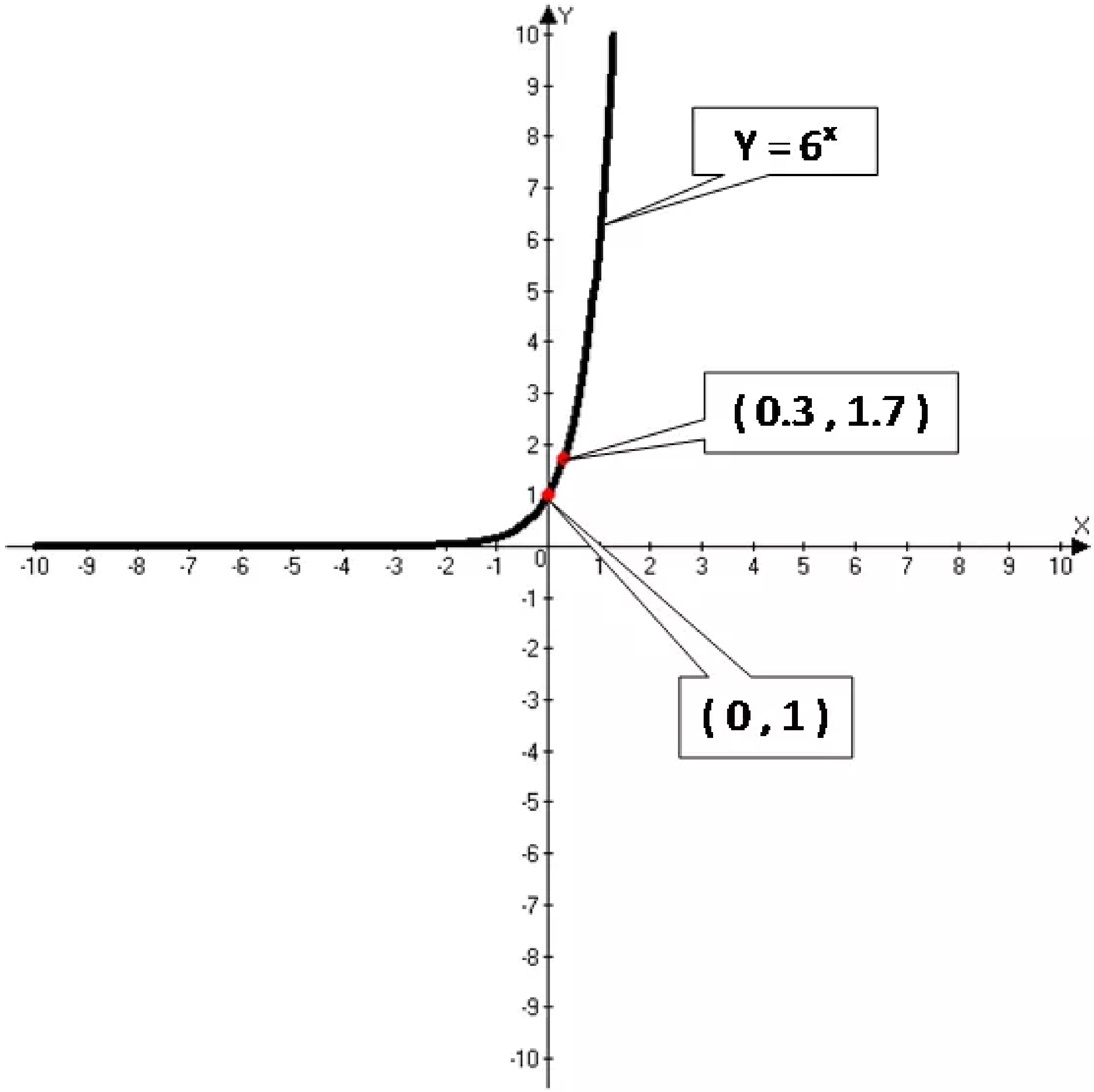
x	y
-2	$6^{-2} = 0.028$
-1	$6^{-1} = 0.16$
0	$6^0 = 1$
0.3	$6^{0.3} = 1.7$
1	$6^1 = 6$
2	$6^2 = 36$

Now, connected all ordered pairs we obtain a smooth curve and the curve $y = 6^x$ is cut at y – axis is (0, 1).

Therefore y – intercept of the graph $y = 6^x$ is $\boxed{1}$

By the graph the value of $6^{0.3}$ is $\boxed{1.7}$

Step2: To find the value of $6^{0.3}$ by using calculator $6^{0.3} = \boxed{1.7117}$



Answer 18PA.

Consider the function $y = f(x) = 8^x; 8^{0.8}$

Claim: Graph the function $y = f(x) = 8^x$ and to find y – intercept.

Step1: Graph the function $y = f(x) = 8^x$

Now construct table for $y = 8^x$. To substitute different values of x in the original equation $y = 8^x$, we obtain y- values. Plotting the all ordered all pairs and connected them. We get a smooth curve.

Table for $y = 8^x$

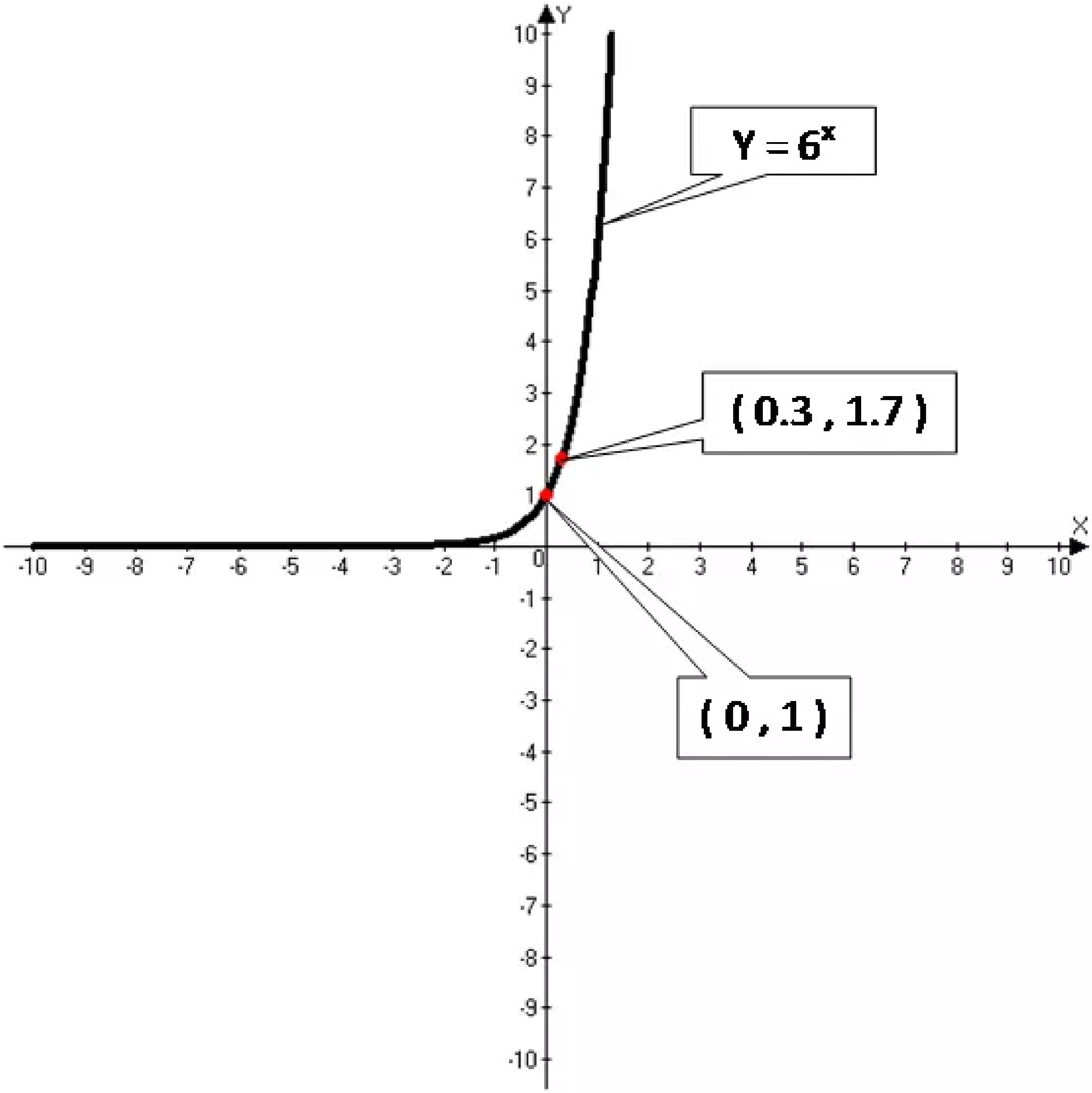
x	y
-2	$8^{-2} = 0.02$
-1	$8^{-1} = 0.13$
0	$8^0 = 1$
0.8	$8^{0.8} = 5.3$
1	$8^1 = 8$
2	$8^2 = 64$

Now, connected all ordered pairs we obtain a smooth curve and the curve $y = 8^x$ is cut at y – axis is (0, 1).

Therefore y – intercept of the graph $y = 8^x$ is $\boxed{1}$

By the graph the value of $8^{0.8}$ is $\boxed{5.3}$

Step2: to find the value of $8^{0.8}$ by using calculator $8^{0.8} = \boxed{5.27803}$



Answer 19PA.

Consider the function $y = 5(2^x)$

Claim: Graph the function $y = 5(2^x)$ and to find the y – intercept of the function $y = 5(2^x)$.

Step1: Graph the function $y = 5(2^x)$

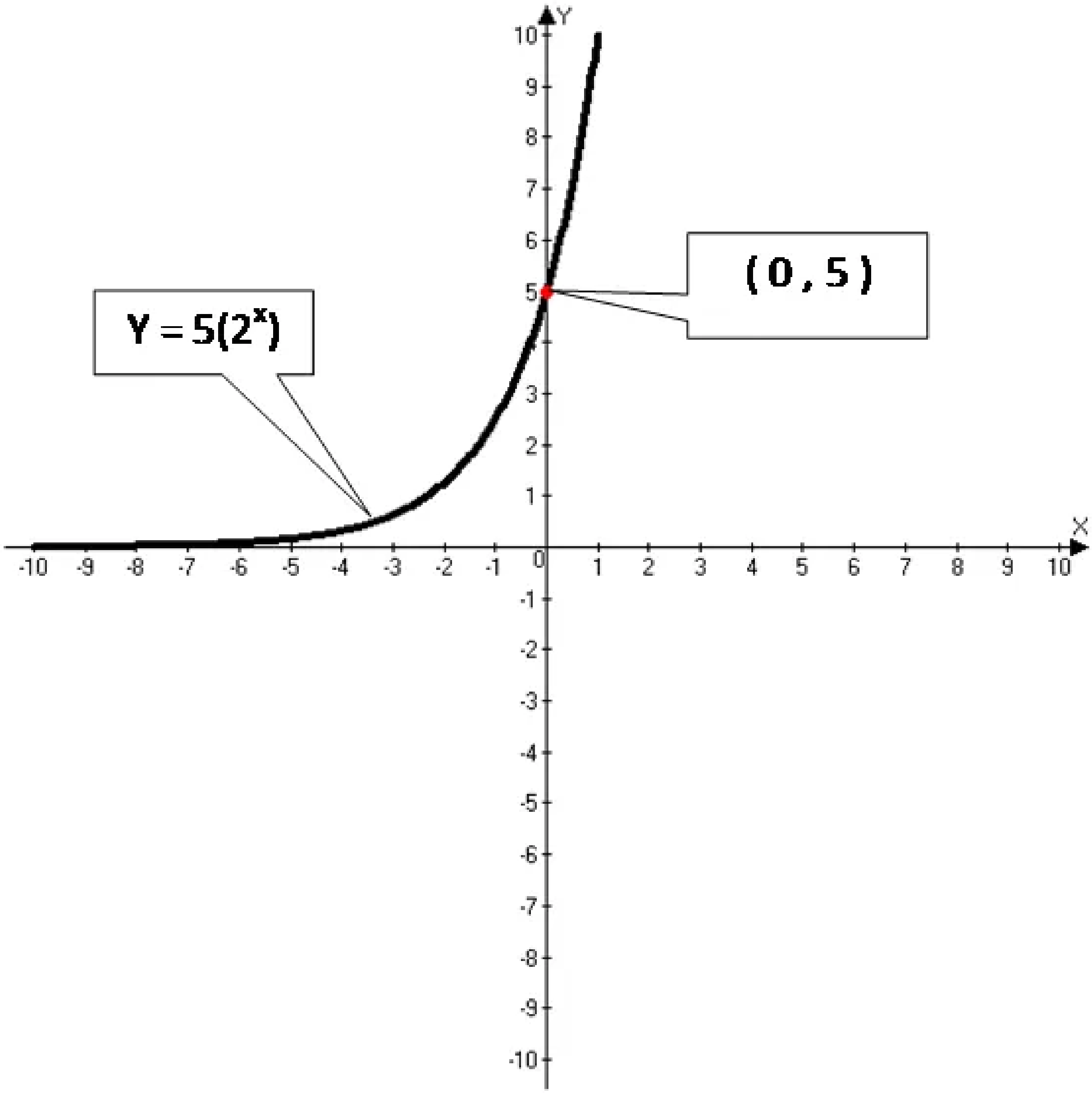
Now, to construct the table for $y = 5(2^x)$

To substitute the different values of x in the original function $y = 5(2^x)$, we obtain the y – values. Plotting these all ordered pairs and connect them, we obtain the curve.

Table for $y = 5(2^x)$

x	$5\cdot(2^x)$	y	(x,y)
-3	$5\cdot(2^{-3}) = 0.625$	0.625	$(-3, 0.625)$
-2	$5\cdot(2^{-2}) = 1.25$	1.25	$(-2, 1.25)$
-1	$5\cdot(2^{-1}) = 2.5$	2.5	$(-1, 2.5)$
0	$5\cdot(2^0) = 5$	5	$(0, 5)$
1	$5\cdot(2^1) = 10$	10	$(1, 10)$
2	$5\cdot(2^2) = 20$	20	$(2, 20)$
3	$5\cdot(2^3) = 40$	40	$(3, 40)$

Now, connect these all ordered pairs we obtain the smooth curve the curve $y = 5(2^x)$ cuts at y – axis is (0, 5). The y – intercept of the curve $y = 5(2^x)$ is $\boxed{5}$



Step2: Verification:

To find the y – intercept of the function $y = 5(2^x)$, put x = 0 is the original function $y = 5(2^x)$

$y = 5(2^x)$ (original function)

$y = 5(2^0)$ (Replace x by 0)

$y = 5 \cdot 1$

$y = 5$

Therefore, the curve $y = 5(2^x)$ cuts at y – axis is (0, 5).

Hence, the y – intercept of the function $y = 5(2^x)$ is $\boxed{5}$

Answer 20PA.

Consider the function $y=3\left(5^x\right)$

Claim: Graph the function $y=3\left(5^x\right)$ and to find the y – intercept of the function $y=3\left(5^x\right)$.

Step1: Graph the function $y=3\left(5^x\right)$

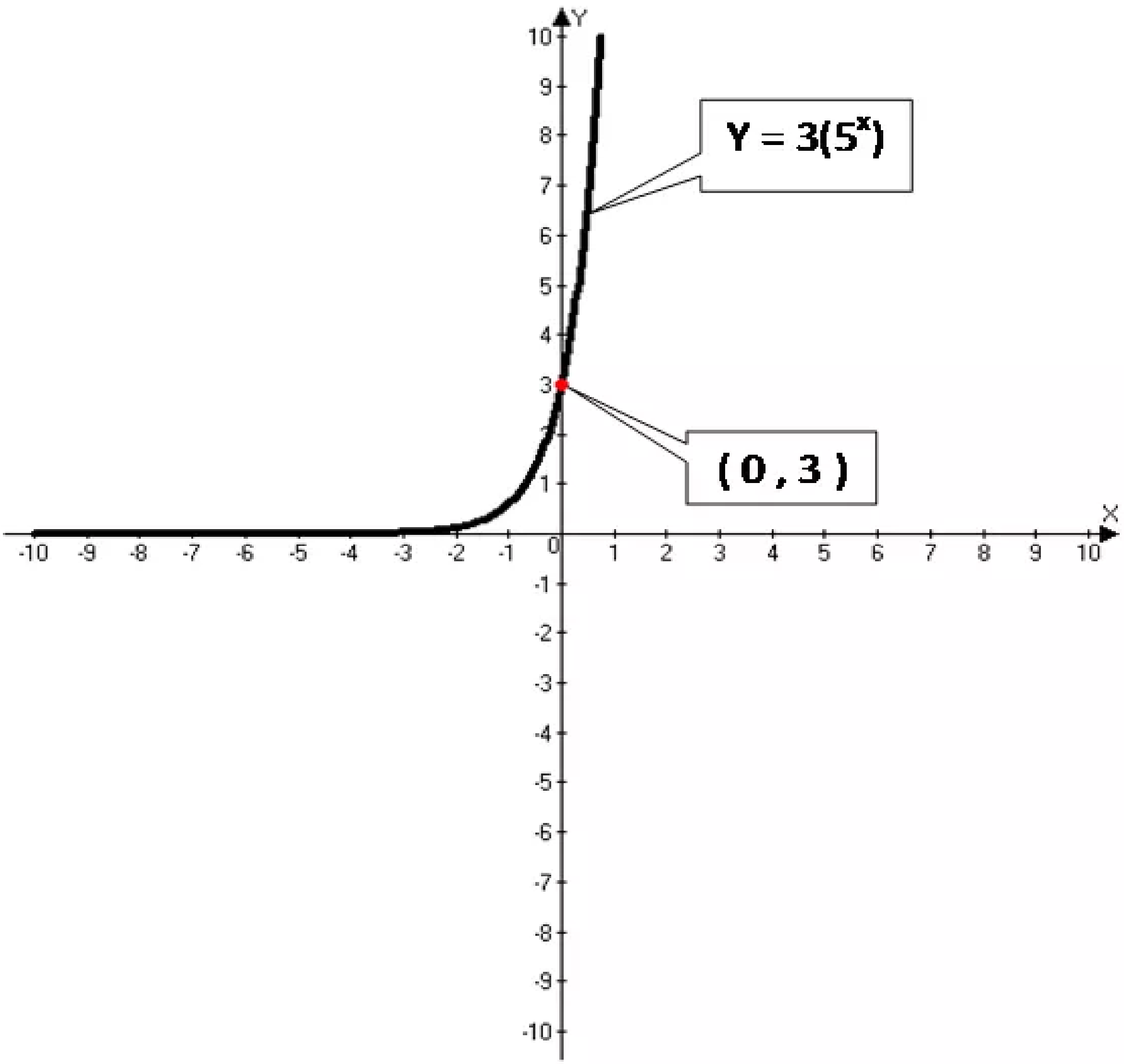
To construct the table for $y=3\left(5^x\right)$

To substitute the different values of x in the original function $y=3\left(5^x\right)$, we obtain the y – values. Plotting these all ordered pairs and connect them, we obtain the curve.

Table for $y=3\left(5^x\right)$

x	$3\left(5^x\right)$	y	(x,y)
-3	$3\left(5^{-3}\right)=0.024$	0.024	$(-3,0.024)$
-2	$3\left(5^{-2}\right)=0.12$	0.12	$(-2,0.12)$
-1	$3\left(5^{-1}\right)=0.6$	0.6	$(-1,0.6)$
0	$3\left(5^0\right)=3$	3	$(0,3)$
1	$3\left(5^1\right)=15$	15	$(1,15)$
2	$3\left(5^2\right)=75$	75	$(2,75)$

Now, connect these all ordered pairs we obtain the smooth curve the curve $y=3\left(5^x\right)$ cuts at y – axis is (0, 3). The y – intercept of the curve $y=3\left(5^x\right)$ is $\boxed{3}$



Step2: Verification:

Now to find the y – intercept of the function $y=3\left(5^x\right)$, put x = 0 is the original function

$$y=3\left(5^x\right)$$

$$y=3\left(5^x\right) \qquad \text{(original function)}$$

$$y=3\left(5^0\right) \qquad \text{(Replace } x \text{ by } 0\text{)}$$

$$y=3\cdot 1$$

$$y=3$$

Therefore, the curve $y=3\left(5^x\right)$ cuts at y – axis is (0, 3).

Hence, the y – intercept of the function $y=3\left(5^x\right)$ is $\boxed{3}$

Answer 21PA.

Consider the function $y = 3^x - 7$

Claim: Graph the function $y = 3^x - 7$ and to find the y – intercept of the function $y = 3^x - 7$.

Step1:

Graph the function $y = 3^x - 7$

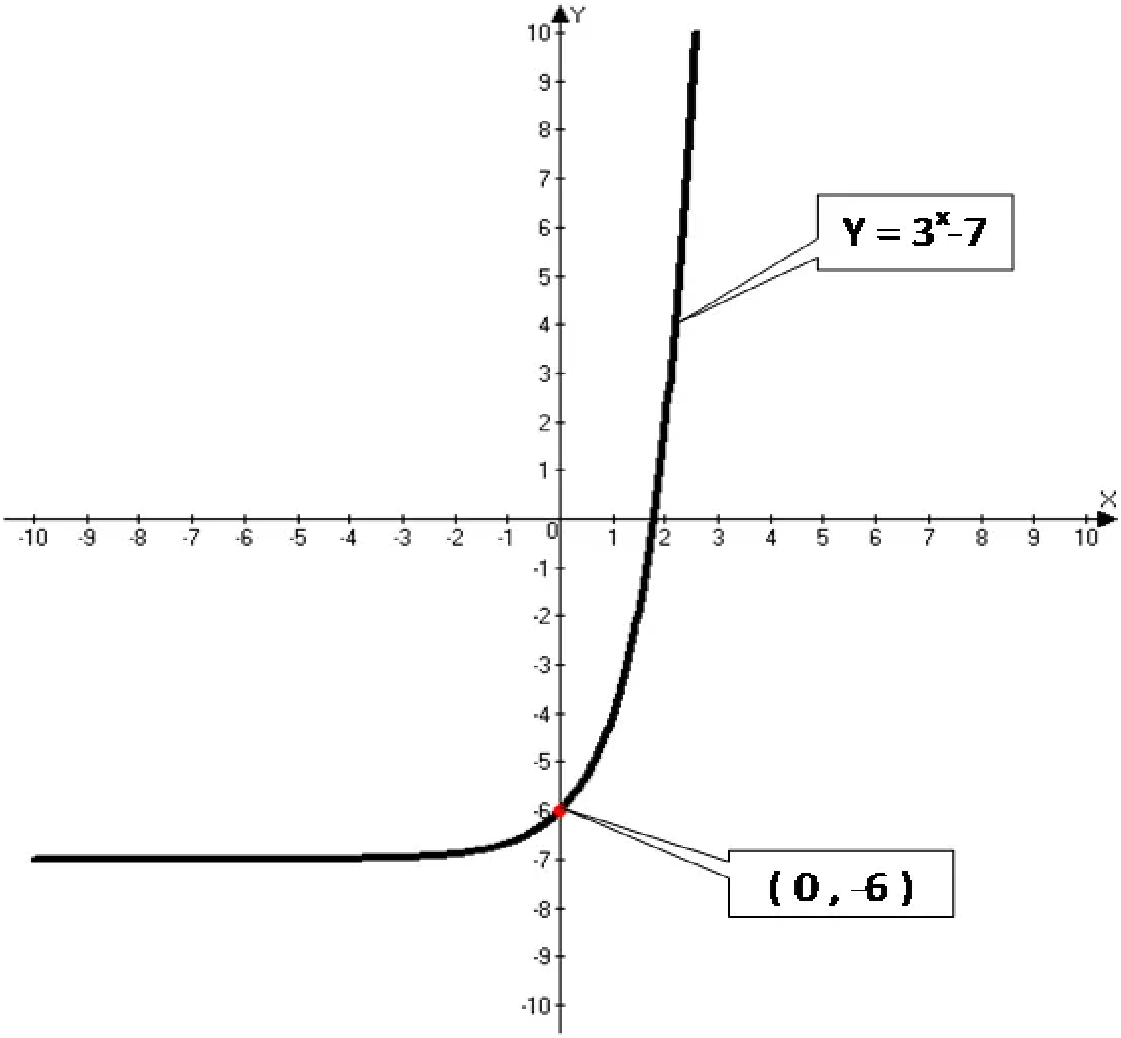
To construct the table for $y = 3^x - 7$

To substitute the different values of x in the original function $y = 3^x - 7$, we obtain the y – values. Plotting these all ordered pairs and connect them, we obtain the curve.

Table for $y = 3^x - 7$

x	$3^x - 7$	y	(x, y)
-3	$3^{-3} - 7 = -6.963$	-6.963	$(-3, -6.963)$
-2	$3^{-2} - 7 = -6.888$	-6.888	$(-2, -6.888)$
-1	$3^{-1} - 7 = -6.666$	-6.666	$(-1, -6.666)$
0	$3^{-1} - 7 = -6$	-6	$(0, -6)$
1	$3^{-1} - 7 = -4$	-4	$(1, -4)$
2	$3^{-1} - 7 = 2$	2	$(2, 2)$
3	$3^{-1} - 7 = 20$	20	$(3, 20)$

Now, connect these all ordered pairs we obtain the smooth curve the curve $y = 3^x - 7$ cuts at *y* – axis is (0, − 6). The *y* – intercept of the curve $y = 3^x - 7$ is $\boxed{-6}$



Step2: Verification:

Now to find the *y* – intercept of the function $y = 3^x - 7$, put *x* = 0 is the original function

$y = 3^x - 7$

$$y = 3^x - 7 \quad \text{(original function)}$$
$$y = 3^0 - 7 \quad \text{(Replace } x \text{ by } 0\text{)}$$
$$y = 1 - 7 \quad \text{(Use the rule } a^0 = 1 \text{ if } a \neq 0\text{)}$$
$$y = -6$$

Therefore, the curve $y = 3^x - 7$ cuts at *y* – axis is (0, −6).

Hence, the *y* – intercept of the function $y = 3^x - 7$ is $\boxed{-6}$

Answer 22PA.

Consider the function $y = 2^x + 4$

Claim: Graph the function $y = 2^x + 4$ and to find the $y-$ intercept of the function $y = 2^x + 4$

Step1:

Graph the function $y = 2^x + 4$

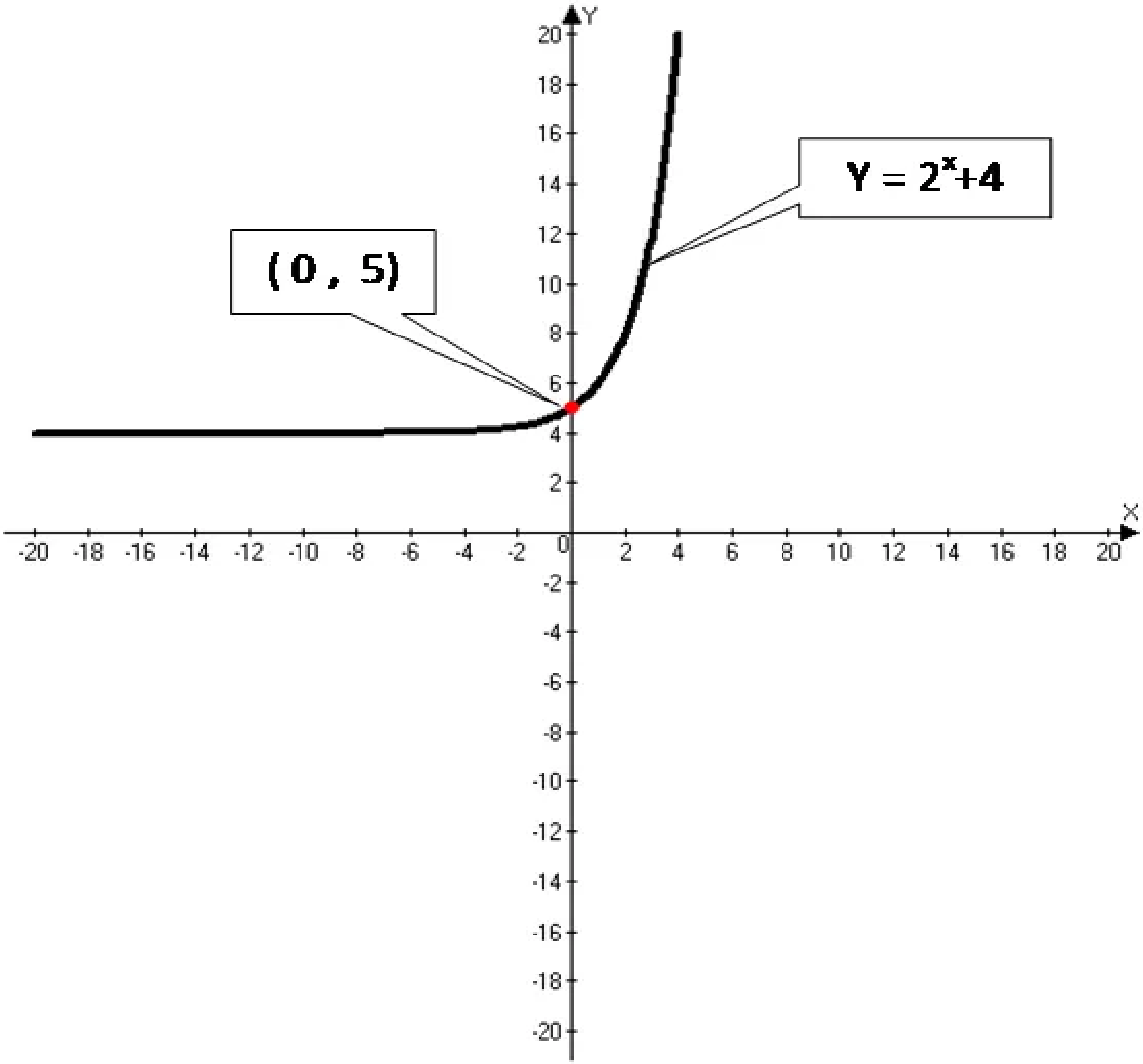
To construct the table for $y = 2^x + 4$

To substitute the different values of x in the original function $y = 2^x + 4$, we obtain the $y-$ values. Plotting these all ordered pairs and connect them, we obtain the curve.

Table for $y = 2^x + 4$

x	$2^x + 4$	y	(x, y)
-3	$2^{-3} + 4 = 4.125$	4.125	$(-3, 4.125)$
-2	$2^{-2} + 4 = 4.25$	4.25	$(-2, 4.25)$
-1	$2^{-1} + 4 = 4.5$	4.5	$(-1, 4.5)$
0	$2^0 + 4 = 5$	5	$(0, 5)$
1	$2^1 + 4 = 6$	6	$(1, 6)$
2	$2^2 + 4 = 8$	8	$(2, 8)$
3	$2^3 + 4 = 12$	12	$(3, 12)$

Now, connect these all ordered pairs we obtain the smooth curve the curve $y = 2^x + 4$ cuts at *y* – axis is (0, 5). The *y* – intercept of the curve $y = 2^x + 4$ is $\boxed{5}$



Step2: Verification:

Now to find the *y* – intercept of the function $y = 2^x + 4$, put *x* = 0 is the original function

$y = 2^x + 4$

$y = 2^x + 4$ (original function)

$y = 2^0 + 4$ (Replace x by 0)

$y = 1 + 4$ (Use the rule $a^0 = 1$ if $a \neq 0$)

$y = 5$

Therefore, the curve $y = 2^x + 4$ cuts at *y* – axis is (0, 5).

Hence, the *y* – intercept of the function $y = 2^x + 4$ is $\boxed{5}$

Answer 23PA.

Consider the function $y = 2(3^x) - 1$

Claim: Graph the function $y = 2(3^x) - 1$ and to find the y – intercept of the function $y = 2(3^x) - 1$

Step1:

Graph the function $y = 2(3^x) - 1$

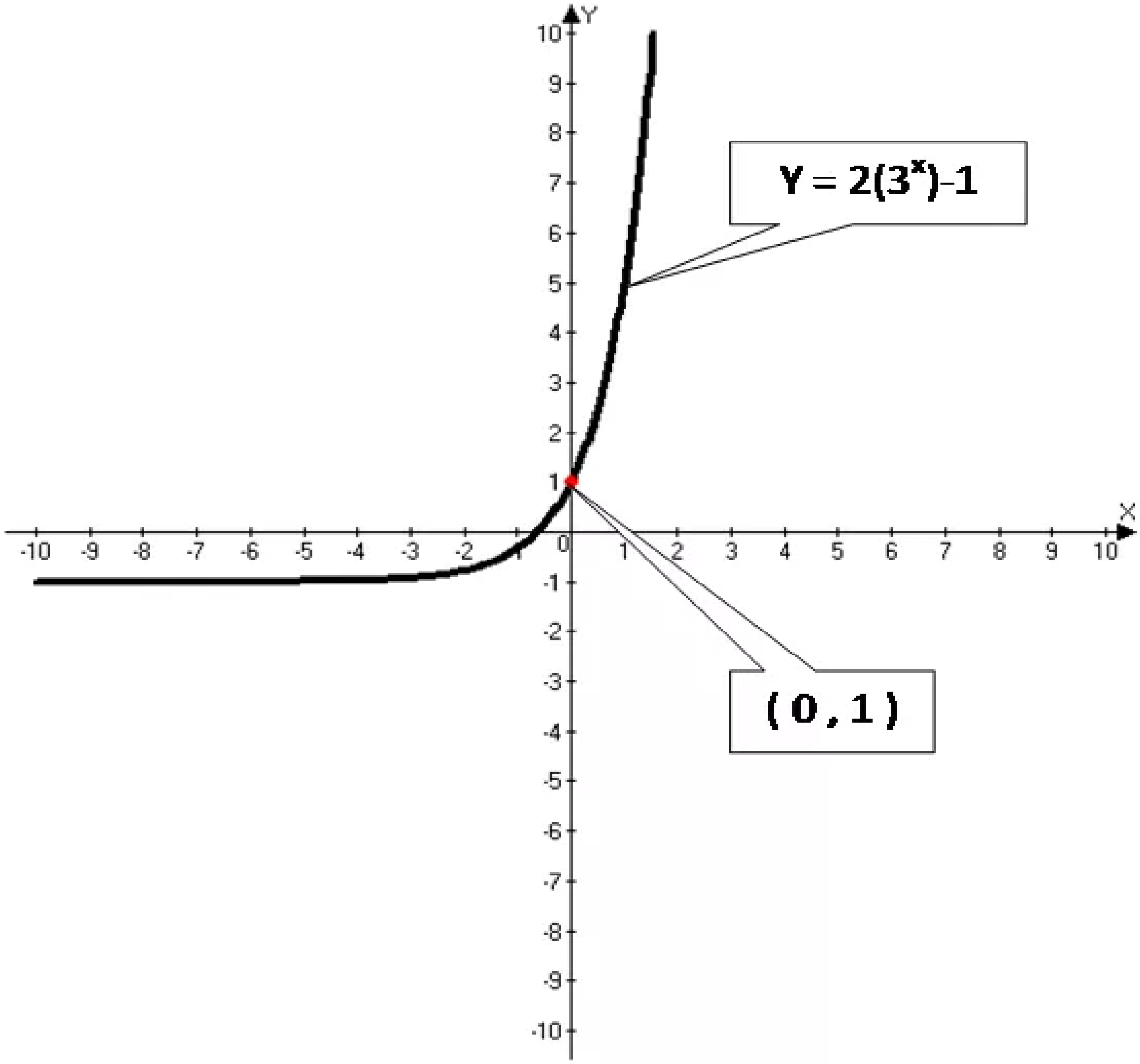
To construct the table for $y = 2(3^x) - 1$

To substitute the different values of x in the original function $y = 2(3^x) - 1$, we obtain the y – values. Plotting these all ordered pairs and connect them, we obtain the curve.

Table for $y = 2(3^x) - 1$

x	$2(3^x)-1$	y	(x,y)
-3	$2(3^{-3})-1=-0.926$	-0.926	$(-3,-0.926)$
-2	$2(3^{-2})-1=-0.777$	-0.777	$(-2,-0.777)$
-1	$2(3^{-1})-1=-0.333$	-0.333	$(-1,-0.333)$
0	$2(3^0)-1=1$	1	$(0,1)$
1	$2(3^1)-1=5$	5	$(1,5)$
2	$2(3^2)-1=17$	17	$(2,17)$
3	$2(3^3)-1=53$	$53.$	$(3,53)$

Now, connect these all ordered pairs we obtain the smooth curve the curve $y = 2(3^x) - 1$ cuts at y – axis is (0, 1). The y – intercept of the curve $y = 2(3^x) - 1$ is $\boxed{1}$



Step2: Verification:

Now to find the y – intercept of the function $y = 2(3^x) - 1$, put x = 0 is the original function

$$y = 2(3^x) - 1$$

$$y = 2(3^x) - 1 \qquad \text{(original function)}$$

$$y = 2(3^0) - 1 \qquad \text{(Replace } x \text{ by 0)}$$

$$y = 2(1) - 1 \qquad \text{(Use the rule } a^0 = 1 \text{ if } a \neq 0\text{)}$$

$$y = 2 - 1$$

$$y = 1$$

Therefore, the curve $y = 2(3^x) - 1$ cuts at y – axis is (0, 1).

Hence, the y – intercept of the function $y = 2(3^x) - 1$ is $\boxed{1}$

Answer 24PA.

Consider the function $y = 5(2^x) + 4$

Claim: Graph the function $y = 5(2^x) + 4$ and to find the *y* – intercept of the function $y = 5(2^x) + 4$

Step1:

Graph the function $y = 5(2^x) + 4$

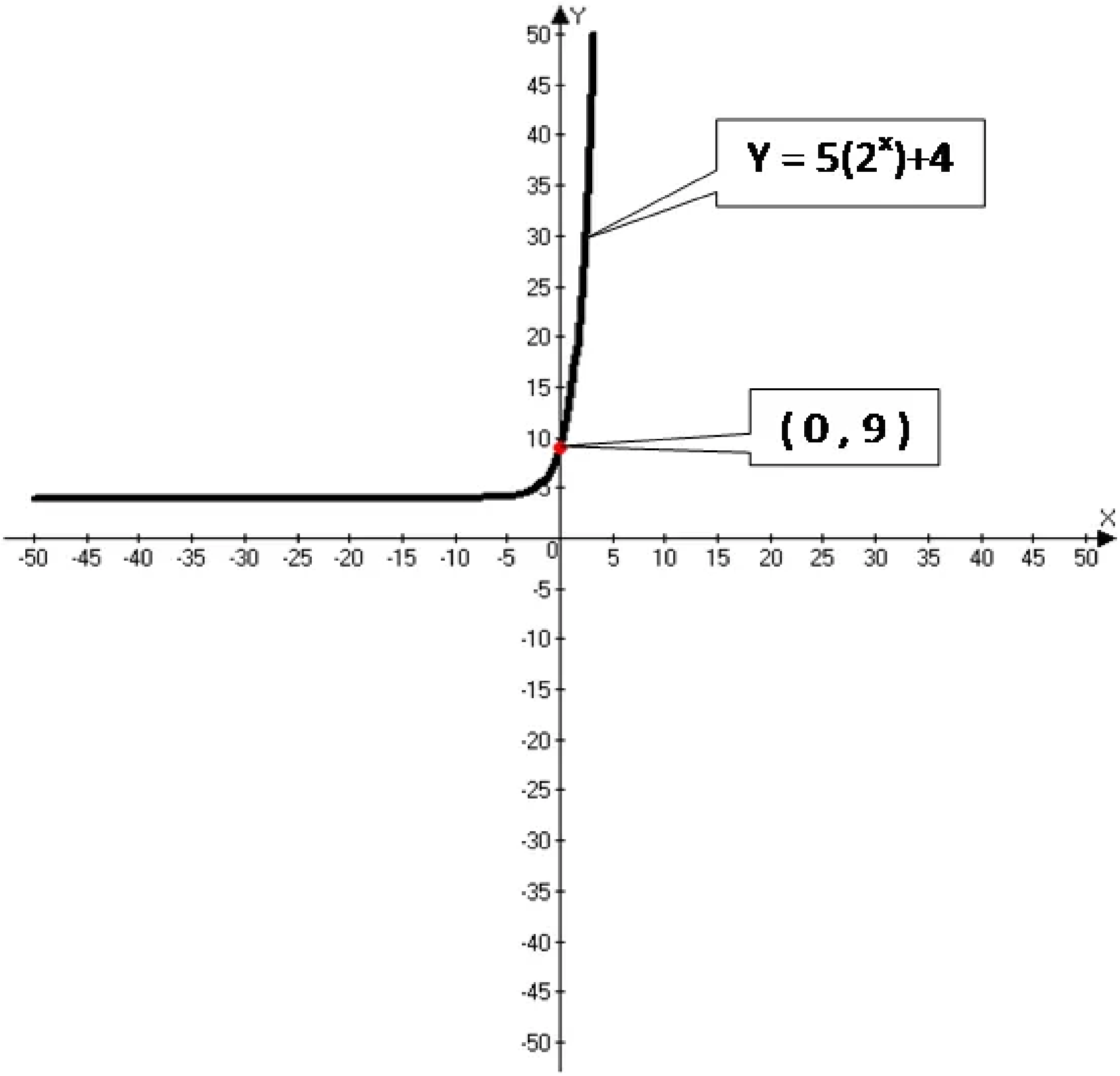
To construct the table for $y = 5(2^x) + 4$

To substitute the different values of *x* in the original function $y = 5(2^x) + 4$, we obtain the *y* – values. Plotting these all ordered pairs and connect them, we obtain the curve.

Table for $y = 5(2^x) + 4$

x	$5(2^x)+4$	y	(x,y)
-3	$5(2^{-3})+4=4.625$	4.625	$(-3,4.625)$
-2	$5(2^{-2})+4=5.25$	5.25	$(-2,5.25)$
-1	$5(2^{-1})+4=6.5$	6.5	$(-1,6.5)$
0	$5(2^0)+4=9$	9	$(0,9)$
1	$5(2^1)+4=14$	14	$(1,14)$
2	$5(2^2)+4=24$	24	$(2,24)$
3	$5(2^3)+4=44$	$44.$	$(3,44)$

Now, connect these all ordered pairs we obtain the smooth curve the curve $y=5\left(2^x\right)+4$ cuts at y – axis is (0, 9). The y – intercept of the curve $y=5\left(2^x\right)+4$ is $\boxed{9}$



<u>Step2</u>: Verification:

Now to find the y – intercept of the function $y=5\left(2^x\right)+4$, put x = 0 is the original function

$$y=5\left(2^x\right)+4$$

$$y=5\left(2^x\right)+4 \qquad \text{(original function)}$$

$$y=5\left(2^0\right)+4 \qquad \text{(Replace } x \text{ by 0)}$$

$$y=5(1)+4 \qquad \left(\text{Use the rule } a^0=1 \text{ if } a\neq 0\right)$$

$$y=5+4$$

$$y=9$$

Therefore, the curve $y=5\left(2^x\right)+4$ cuts at y – axis is (0, 9).

Hence, the y – intercept of the function $y=5\left(2^x\right)+4$ is $\boxed{9}$

Answer 25PA.

Consider the function $y=2\left(3^x+1\right)$

Claim: Graph the function $y=2\left(3^x+1\right)$ and to find the *y* – intercept of the function $y=2\left(3^x+1\right)$

Step1:

Graph the function $y=2\left(3^x+1\right)$

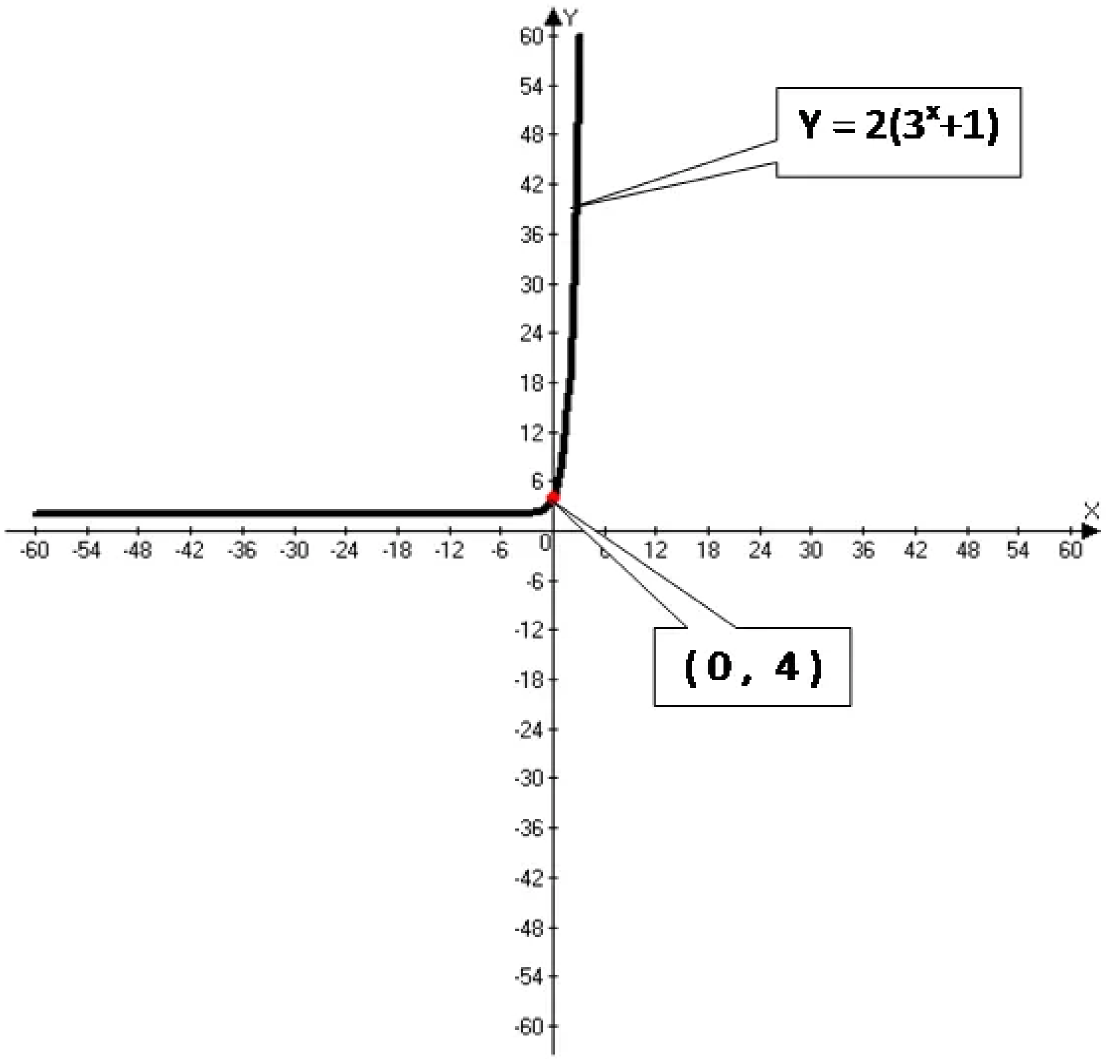
To construct the table for $y=2\left(3^x+1\right)$

To substitute the different values of *x* in the original function $y=2\left(3^x+1\right)$, we obtain the *y* – values. Plotting these all ordered pairs and connect them, we obtain the curve.

Table for $y=2\left(3^x+1\right)$

x	$2\left(3^x+1\right)$	y	(x,y)
-3	$2\left(3^{-3}+1\right)=2.074$	2.074	$(-3,2.074)$
-2	$2\left(3^{-2}+1\right)=2.222$	2.222	$(-2,2.222)$
-1	$2\left(3^{-1}+1\right)=2.666$	2.666	$(-1,2.666)$
0	$2\left(3^{0}+1\right)=4$	4	$(0,4)$
1	$2\left(3^{1}+1\right)=8$	8	$(1,8)$
2	$2\left(3^{2}+1\right)=20$	20	$(2,20)$
3	$2\left(3^{3}+1\right)=56$	$56.$	$(3,56)$

Now, connect these all ordered pairs we obtain the smooth curve the curve $y = 2(3^x + 1)$ cuts at *y* – axis is (0, 4). The *y* – intercept of the curve $y = 2(3^x + 1)$ is $\boxed{4}$



Step2: Verification:

Now to find the *y* – intercept of the function $y = 2(3^x + 1)$, put *x* = 0 is the original function

$y = 2(3^x + 1)$

$y = 5(2^x) + 4$ (original function)

$y = 5(2^0) + 4$ (Replace x by 0)

$y = 5(1) + 4$ (Use the rule $a^0 = 1$ if $a \neq 0$)

$y = 5 + 4$

$y = 9$

Therefore, the curve $y = 2(3^x + 1)$ cuts at *y* – axis is (0, 4).

Hence, the *y* – intercept of the function $y = 2(3^x + 1)$ is $\boxed{4}$

Answer 26PA.

Consider the function $y = 3\left(2^x - 5\right)$

Claim: Graph the function $y = 3\left(2^x - 5\right)$ and to find the y – intercept of the function

$y = 3\left(2^x - 5\right)$

Step1:

Graph the function $y = 3\left(2^x - 5\right)$

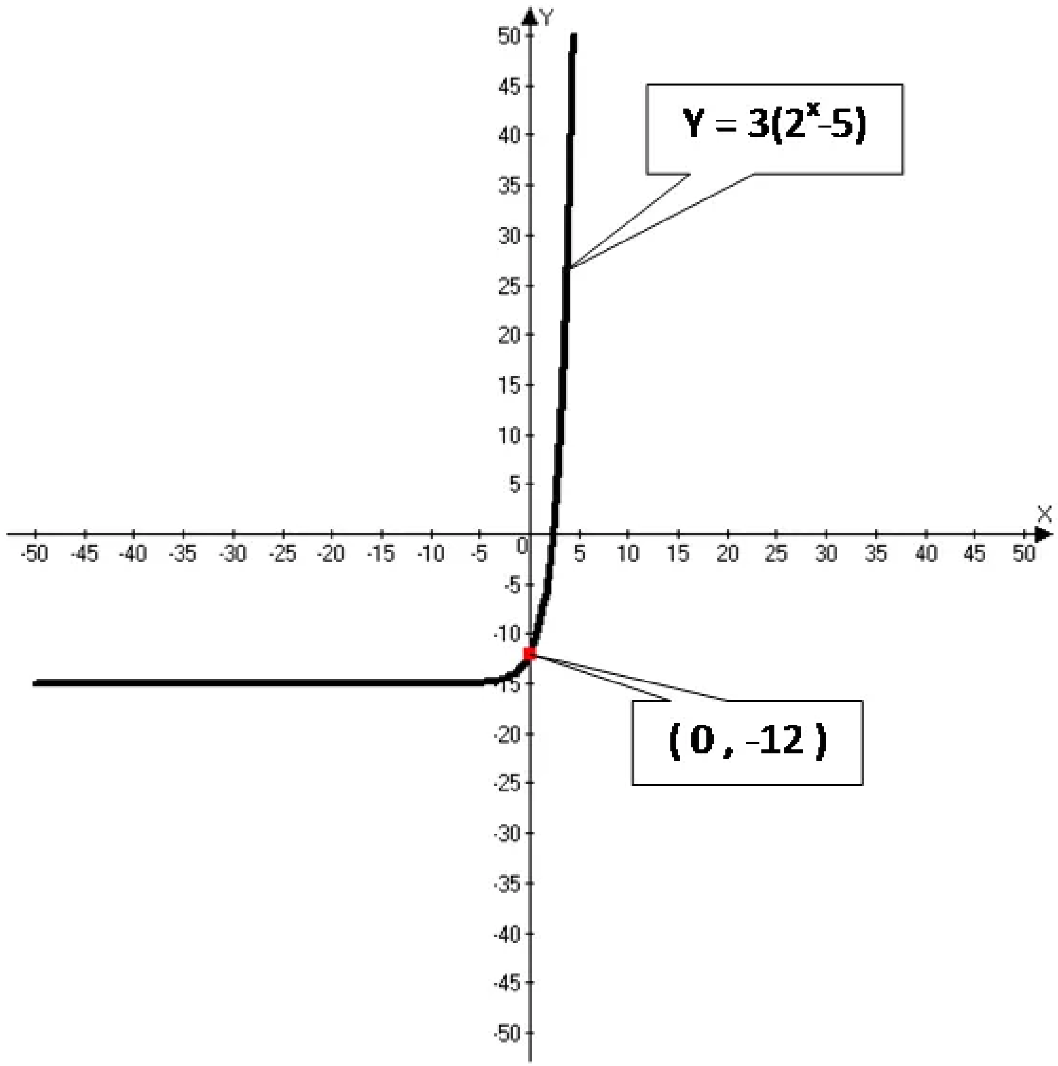
To construct the table for $y = 3\left(2^x - 5\right)$

To substitute the different values of x in the original function $y = 3\left(2^x - 5\right)$, we obtain the y – values. Plotting these all ordered pairs and connect them, we obtain the curve.

Table for $y = 3\left(2^x - 5\right)$

x	$3\left(2^x - 5\right)$	y	(x, y)
-3	$3\left(2^{-3} - 5\right) = -14.625$	-14.625	$(-3, -14.625)$
-2	$3\left(2^{-2} - 5\right) = -14.25$	-14.25	$(-2, -14.25)$
-1	$3\left(2^{-1} - 5\right) = -13.5$	-13.5	$(-1, -13.5)$
0	$3\left(2^{0} - 5\right) = -12$	-12	$(0, -12)$
1	$3\left(2^{1} - 5\right) = -9$	-9	$(1, -9)$
2	$3\left(2^{2} - 5\right) = -3$	-3	$(2, -3)$
3	$3\left(2^{3} - 5\right) = 12$	$12.$	$(3, 12)$

Now, connect these all ordered pairs we obtain the smooth curve the curve $y = 3(2^x - 5)$ cuts at y – axis is (0, −12). The y – intercept of the curve $y = 3(2^x - 5)$ is $\boxed{-12}$



Step2: Verification:

Now to find the y – intercept of the function $y = 3(2^x - 5)$, put x = 0 is the original function

$y = 3(2^x - 5)$

$y = 3(2^x - 5)$ (original function)

$y = 3(2^0 - 5)$ (Replace x by 0)

$y = 3(1 - 5)$ (Use the rule $a^0 = 1$ if $a \neq 0$)

$y = 3 \cdot -4$

$y = -12$

Therefore, the curve $y = 3(2^x - 5)$ cuts at y – axis is (0, −12).

Hence, the y – intercept of the function $y = 3(2^x - 5)$ is $\boxed{-12}$

Answer 27PA.

Consider the following data

x	−2	−1	0	1
y	−5	−2	1	4

Step1: look for a pattern

The domain values are regular interval of "1" the range values have a common difference "3"

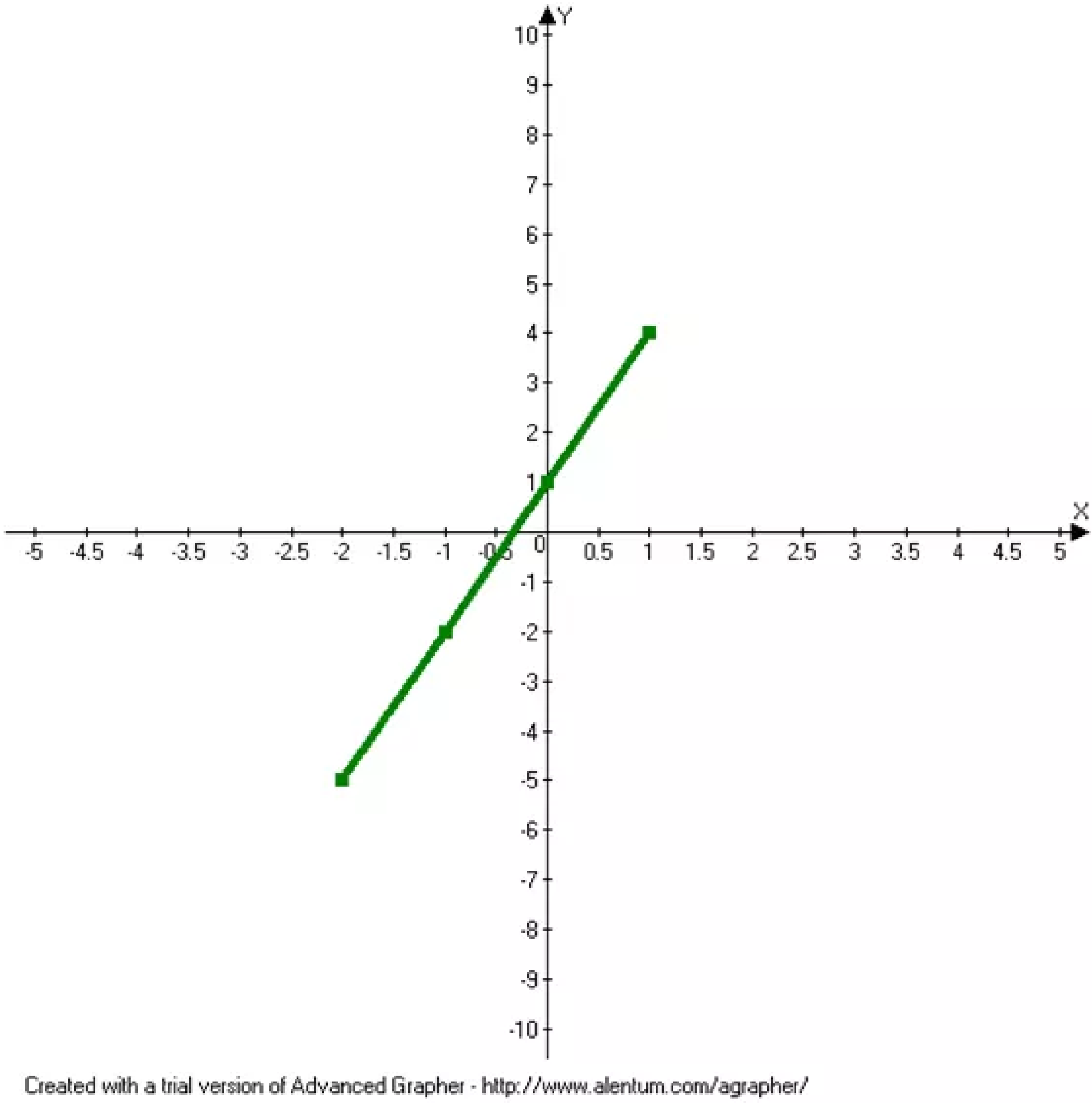
−5 −2 1 4

+3 +3 +3

The data do not display exponential behavior, but rather linear behavior.

Hence, $\boxed{\text{No}}$, the domain values are at regular intervals and range values have a common difference $\boxed{3}$

Step2: Graph the data



We observe that, this is a graph of line not an exponential function.

Answer 28PA.

Consider the data

x	0	1	2	3
y	1	0.5	0.25	0.125

Step1: look for a pattern

The domain values are regular interval of "1" the range values have a common difference "3"

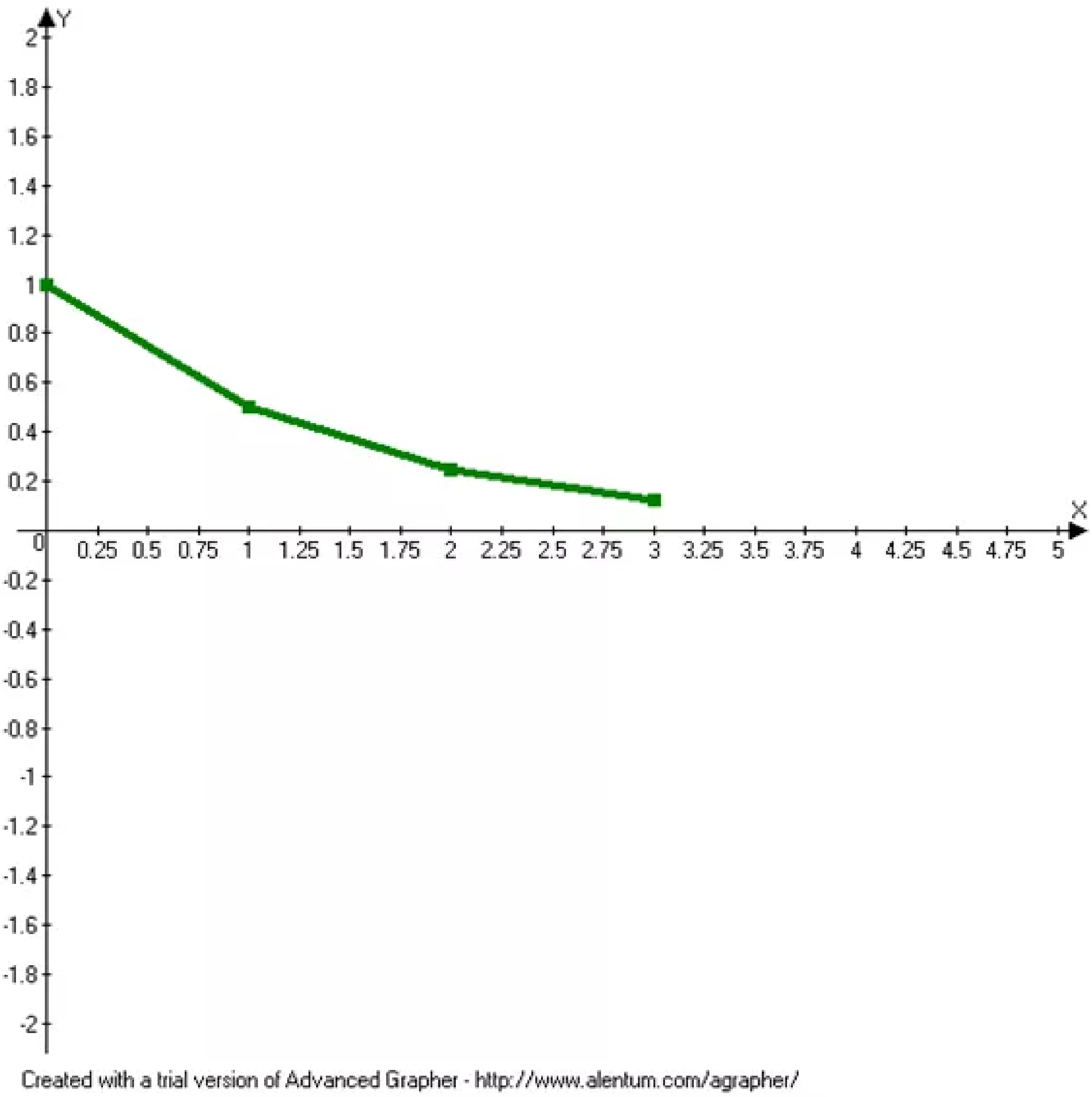
1 0.5 0.25 0.125

$\times 0.5$ $\times 0.5$ $\times 0.5$

Therefore, the domain values are regular intervals and the range values have a common factor "0.5"

Hence, $\boxed{\text{yes}}$ the data are probably exponential. The equation for the data may involve $(0.5)^x$.

Step2: Graph the data



The graph shows rapidly decreasing values of *y* as *x* increases. This is a characteristic of exponential behavior.

Answer 29PA.

Consider the following data

x	10	20	30	40
y	16	12	9	6.75

Step1: Look for a pattern

The domain values are regular interval of"10" let's see there is a common factor among the range values

16 12 9 6.75

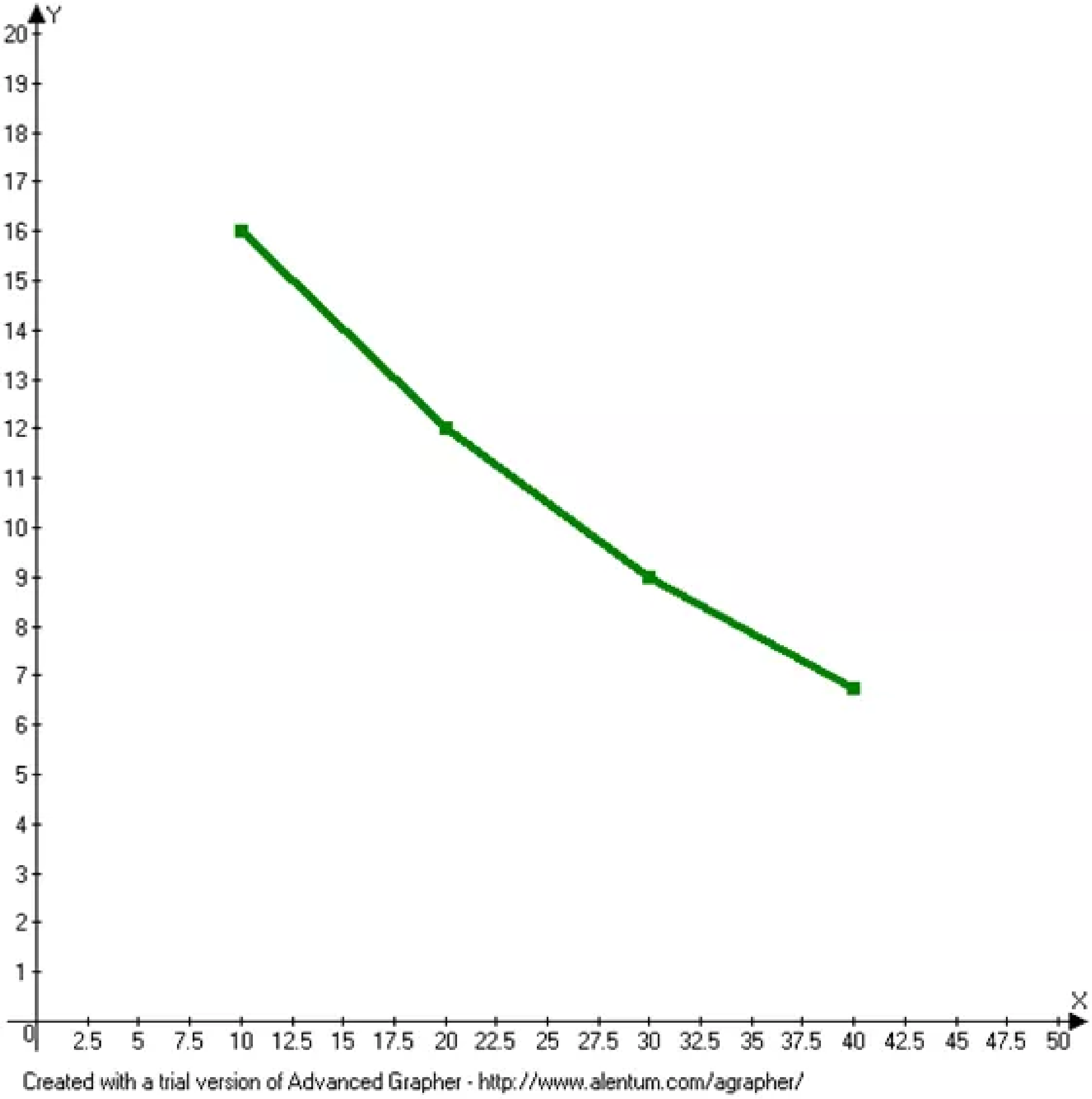
$\times 3/4$ $\times 3/4$ $\times 3/4$

Therefore, the domain values are regular intervals and the range values have a common factor $\boxed{\frac{3}{4}}$

Hence, $\boxed{\text{yes}}$ the data values are probably exponential. The equation for the day may involve

$\boxed{\frac{3}{4}}^x$ or $(0.75)^x$

Step2: Graph the data



We observe that, the graph shows a rapidly decreasing values of *y* as *x* increases.. This is a characteristic of exponential function.

Answer 30PA.

Consider the data

x	−1	0	1	2
y	−0.5	1.0	−2.0	4.0

Step1: Look for a pattern

The domain values are regular interval of"1" let's see there is a common factor among the range values

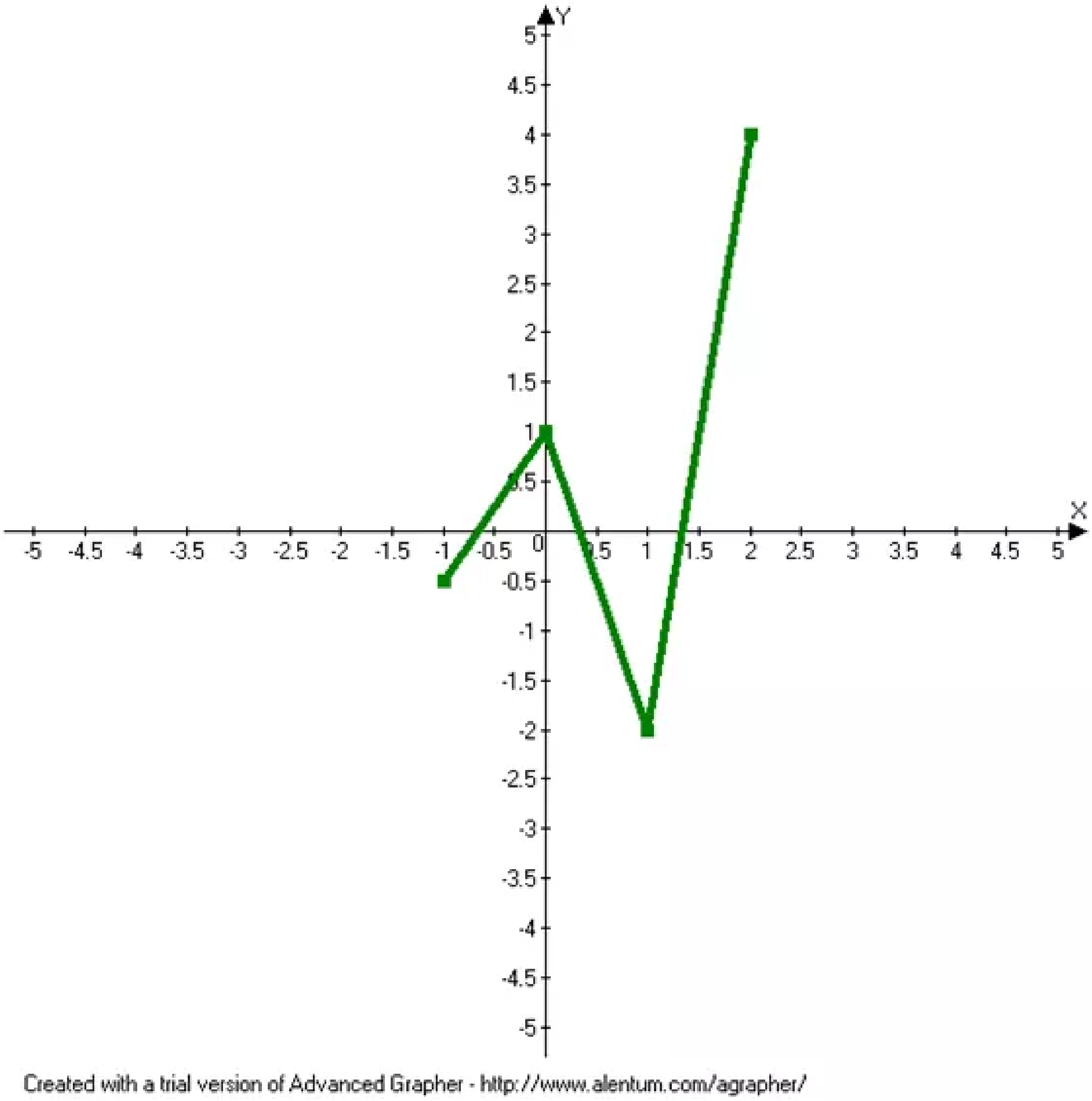
$-0.5 \qquad 1.0 \qquad -2.0 \qquad 4.0$

$\times -2 \qquad \times -2 \qquad \times -2$

Therefore, the domain values are regular intervals and the range values have a common factor " -2 ".

Hence, $\boxed{\text{yes}}$ the data values are probably exponential. The equation for the data may involve $(-2)^x$

Step2: Graph the data



The graph shows rapidly decreasing values of *y* as *x* increasing. This is a characteristic of exponential behavior.

Answer 31PA.

Consider the data

x	3	6	9	12
y	5	5	5	5

Step1: Look for a pattern

The domain values are regular interval of"3" let's the range values have a common difference '0'.

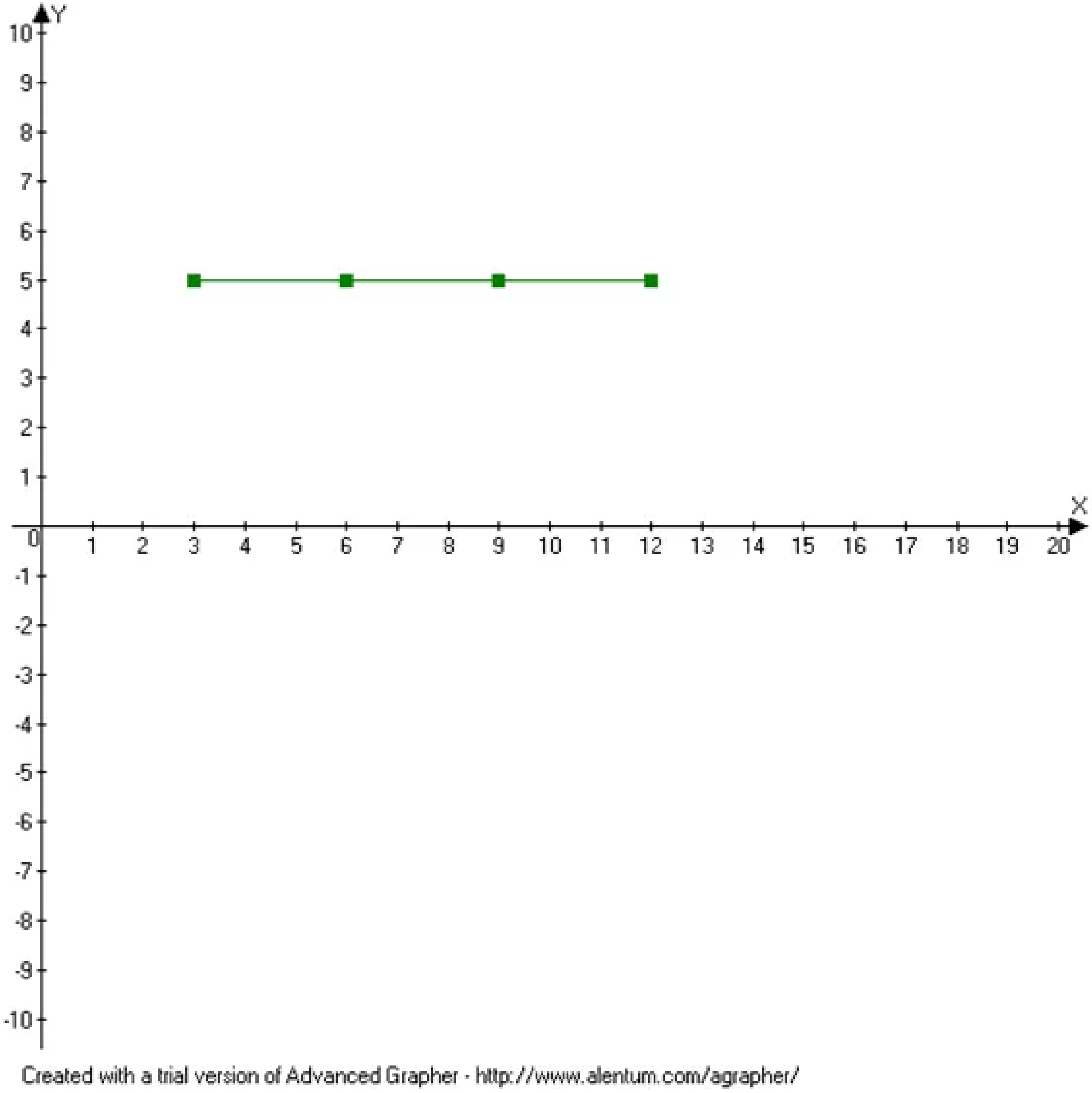
5 5 5 5

+0 +0 +0

Therefore, the data do not display exponential behavior, but rather linear behavior.

Hence, $\boxed{\text{No}}$ the domain values are at regular intervals, but the range values have common difference '0' (the range values do not change)

Step2: Graph the data



We observe that, this is a graph of a line, not an exponential function.

Answer 32PA.

Consider the following data

x	5	3	1	-1
y	32	16	8	4

<u>Step1</u>: Look for a pattern

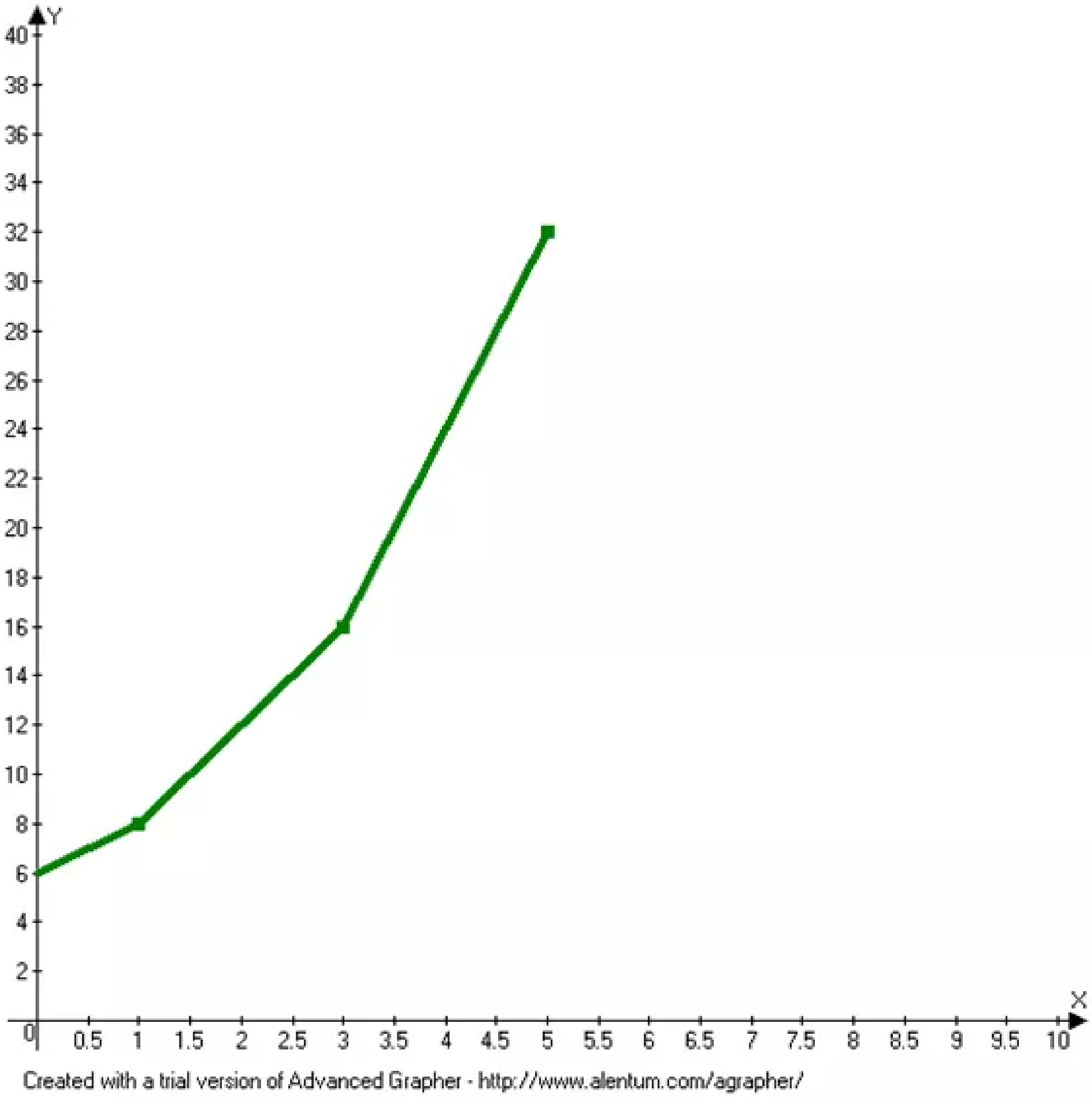
The domain values are regular interval of" -2" let's see if there is a common factor among the range values.

$$32 \quad 16 \quad 8 \quad 4$$
$$\times 1/2 \quad \times 1/2 \quad \times 1/2$$

Therefore, the domain values are at regular intervals and the range values have a common factor $\left(\frac{1}{2}\right)$.

Hence, $\boxed{\text{yes}}$ the data a probably exponential the equation for the data a may involve $\left(\frac{1}{2}\right)^x$.

Step2: Graph the data



The graph shows rapidly decreasing values of a exponential function

Answer 33PA.

Consider the amount of money spent at west outlet mall in midtown continue to increases. The total $T(x)$ in millions of dollars can be estimated by the function

$T(x) = 12(1.12)^x$ where x is the number of years after if open in 1995

Claim: To find the amount of sales for the mall in years 2005, 2006 and 2007.

Case 1: To find the amount of sales for the mall in the year 2005.

The year x = current year – opened year

$$= 2005 - 1995$$
$$x = 10$$

After 10 years to find the amount of sales for the mall

Now, substitute x = 10 in the original function

$$T(x) = 12(1.12)^x$$

$$\begin{aligned} T(x) &= 12(1.12)^x && \text{original function} \\ T(10) &= 12(1.12)^{10} && \text{replace } x \text{ by } 10 \\ &= 12(3.1058) \\ &= 37.27 \end{aligned}$$

Therefore, after 10 years (in 2005 years), the amount of sales for the mall is

$$\boxed{\$37.27 \text{ millions}}$$

Hence, 37.27 millions sales in 2005

To find the amount of sales for the mall in the year 2006

The year x = current year – opened year

$$= 2006 - 1995$$
$$= 11$$

After 11 years to find the amount of sales for the mall

Now, substitute x = 11 in the original function

$$\begin{aligned} T(x) &= 12(1.12)^x \\ T(11) &= 12(1.12)^{11} && (\text{Replace } x \text{ by } 11) \\ &= 12(3.4785) \\ &= 41.74 \end{aligned}$$

Therefore, After 11 year (in 2006), the amount of sales for the mall is $\boxed{\$41.74 \text{ millions}}$

Hence, 41.74 millions sales in 2006

Case 3: To find the amount of sales for the mall in the year 2007.

The year x = current year – opened year

$$= 2007 - 1995$$
$$= 12$$

After 12 years to find the amount of sales for the mall

Now, substitute x = 12 in the original function

$$T(x) = 12(1.12)^x$$
$$T(12) = 12(1.12)^{12} \quad (\text{Replace } x \text{ by } 12)$$
$$= 12(3.896)$$
$$= 46.75$$

Therefore, After 12 year (in 2007), the amount of sales for the mall is $\boxed{\$46.75 \text{ millions}}$

Hence, 46.75 millions sales in 2007

Answer 34PA.

Consider the function $T(x) = 12(1.12)^x$

Claim: Graph the function $T(x) = 12(1.12)^x$ and to find y – intercept.

Step1: Graph the function $T(x)=12(1.12)^x$

Now construct table for $T(x)=12(1.12)^x$. To substitute different values of *x* in the original equation $T(x)=12(1.12)^x$, we obtain *y* – values. Plotting the this ordered all pairs and connected them. We get a smooth curve

Table for $T(x)=12(1.12)^x$

x	$T(x)=12(1.12)^x$
−3	$12(1.12)^{-3}=8.54$
−2	$12(1.12)^{-2}=9.57$
−1	$12(1.12)^{-1}=10.71$
0	$12(1.12)^{0}=12$
0.3	$12(1.12)^{1}=13.44$
1	$12(1.12)^{2}=15.05$
2	$12(1.12)^{3}=16.86$

Now, connect all ordered pairs. We obtain smooth curve and the curve $T(x)=12(1.12)^x$ is cut at *y* – axis is (0, 12).

Therefore *y* – Intercept of the graph $T(x)=12(1.12)^x$ is $\boxed{12}$

Answer 35PA.

Consider the amount of money spent at west outlet mall in midtown continue to increases.

The total $T(x)$ in millions of dollars can be estimated by the function

$T(x)=12(1.12)^x$ where x is the number of years after if open in 1995

Claim: To find the y – intercept represent in this problem

According to the problem

The initial year is 1995

Now, we have to find the y – intercept of the function $T(x)=12(1.12)^x$

Put x = 0 in the original function

$T(x)=12(1.12)^x$, we obtain y – intercept of the function

$$
\begin{aligned}
T(x) &= 12(1.12)^x && \text{original function} \\
\mathrm{T}(0) &= 12(1.12)^0 && \text{replace } x \text{ by } 0 \\
&= 12(1) \\
&= 12
\end{aligned}
$$

Therefore, the curve $T(x)=12(1.12)^x$ cuts at y – axis is $(0,12)$. Here x = 0means the initial years. According to the problem, the initial year is 1995

Therefore, y – intercept of the function is $\boxed{\$12\text{millions sales in }1995}$

Hence, $\boxed{\$12\text{millions sales}}$ in the initial year $\boxed{1995}$

Answer 36PA.

Consider the bacteria *E* cell function

According to the problem $E(0)=100$

The cell divides into two identical cell

It can reproduce itself in 5 minutes

Initially the number of Bacteria = 100

Per 15 minutes it will be expanded

In 1st 15 minutes bacteria E = 200b

In 2nd 15 minutes bacteria E = 400b

In 3rd 15 minutes bacteria E = 600b

In 4th 15 minutes bacteria E = 1600b

In one hour the bacteria = 1600

We can write the function $\boxed{y=(100)2^x}$

x = time period 15 minutes

y = number of bacteria

$\text{If } x=0; y=100\cdot(2)^0=100$

$\text{If } x=1; y=100\cdot(2)^1=200$

$\text{If } x=2; y=100\cdot(2)^2=400$

$\text{If } x=3; y=100\cdot(2)^3=800$

$\text{If } x=4; y=100\cdot(2)^4=1600$

In one hour the bacteria = 1600

Answer 37PA.

In a regional quiz bowl competition, three schools compute and winner advances to the next round. Therefore, after each round, only $\frac{1}{3}$ of school remain in the competition for the next round. Suppose 729 schools.

Now start the competition

First round winners are = (Total number of schools)

(After each round only $\frac{1}{3}$ of schools = $= 729 \cdot \left(\frac{1}{3}\right)^1$

The second round winners are = (first round winners)

(After each round only $\frac{1}{3}$ of schools = $= 729 \cdot \left(\frac{1}{3}\right)^2$

The third round winners are = ((second round winners))

(After each round only $\frac{1}{3}$ of schools = $= 729 \cdot \left(\frac{1}{3}\right)^3$

The fourth round winners are = (Third round winners)

(After each round only $\frac{1}{3}$ of schools = $= 729 \cdot \left(\frac{1}{3}\right)^4$

Therefore the *n*th round winners is $= \left((n-1)^{th} \text{ winner}\right)$

(The number of remaining school $\frac{1}{3}$)

$= 729 \cdot \left(\frac{1}{3}\right) \cdot \frac{1}{3}$

The $\left(x^4\right)^{th}$ round winner is = $\left((x-1)^{th} \text{ winner}\right)$(After each round only $\frac{1}{3}$ of each schools)

$$= 729\left(\frac{1}{3}\right)^{x-1} \cdot \left(\frac{1}{3}\right)^1$$

$$= 729\left(\frac{1}{3}\right)^x$$

Hence, the number of schools remaining after *x* rounds is $\boxed{s(x) = 729\left(\frac{1}{3}\right)^x}$

Where $s(x)$ represent the number of schools after remaining *x* rounds

Answer 38PA.

In a regional quiz bowl competition, three schools compute and winner advances to the next round. Therefore, after each round, only $\frac{1}{3}$ of school remain in the competition for the next round. Suppose 729 schools.

Now start the competition

Claim: To find how many schools are left after 3 rounds.

Step1: To write an exponential function to the number of schools remaining after '*x*' rounds.

First round winners are = (Total number of schools)

(After each round only $\frac{1}{3}$ of schools = $= 729\cdot\left(\frac{1}{3}\right)^1$

The second round winners are = (first round winners)

(After each round only $\frac{1}{3}$ of schools = $= 729\cdot\left(\frac{1}{3}\right)^2$

The third round winners are = ((second round winners))

(After each round only $\frac{1}{3}$ of schools = $= 729\cdot\left(\frac{1}{3}\right)^3$

The fourth round winners are = (Third round winners)

(After each round only $\frac{1}{3}$ of schools = $= 729\cdot\left(\frac{1}{3}\right)^4$

Therefore the *n*th round winners is $=\left((n-1)^{th}\ \text{winner}\right)$

(The number of remaining school $\frac{1}{3}$)

= $729\cdot\left(\frac{1}{3}\right)\cdot\frac{1}{3}$

The $(x^4)^{th}$ round winner is = $\left((x-1)^{th}\ \text{winner}\right)$(After each round only $\frac{1}{3}$ of each schools)

$$= 729\left(\frac{1}{3}\right)^{x-1}\cdot\left(\frac{1}{3}\right)^{1}$$

$$= 729\left(\frac{1}{3}\right)^{x}$$

Hence, the number of schools remaining after *x* rounds is $\boxed{s(x) = 729\left(\frac{1}{3}\right)^{x}}$

Therefore, the number of school remaining after '*x*' round is $729\left(\frac{1}{3}\right)^{x}$

Step2: To find the number of school remaining after 3 rounds.

Now, substitute *x* = 3in the original function $s(x) = 729\left(\frac{1}{3}\right)^{x}$ where $s(x)$ represent the number of schools after remaining '*x*' rounds.

$$s(x) = 729\left(\frac{1}{3}\right)^{x}$$

$$s(3) = 729\left(\frac{1}{3}\right)^{3} \qquad (\text{Replace } x \text{ by } 3)$$

$$= 729\frac{1}{3^3}$$

$$= 729\cdot\frac{1}{27}$$

$$= 27\cdot 27\cdot\frac{1}{27}$$

$$= 27$$

Hence, the remaining schools after 3 rounds is $\boxed{27}$

Answer 39PA.

In a regional quiz bowl competition, three schools compute and winner advances to the next round. Therefore, after each round, only $\frac{1}{3}$ of school remain in the competition for the next round. Suppose 729 schools, start the competition

Claim: To find the how many rounds will it take to declare a champion..

Step1: To write the function to the number of schools after '*x*' rounds.

First round winners are = (Total number of schools)

(After each round only $\frac{1}{3}$ of schools = $= 729 \cdot \left(\frac{1}{3}\right)^1$

The second round winners are = (first round winners)

(After each round only $\frac{1}{3}$ of schools = $= 729 \cdot \left(\frac{1}{3}\right)^2$

The third round winners are = ((second round winners))

(After each round only $\frac{1}{3}$ of schools = $= 729 \cdot \left(\frac{1}{3}\right)^3$

The fourth round winners are = (Third round winners)

(After each round only $\frac{1}{3}$ of schools = $= 729 \cdot \left(\frac{1}{3}\right)^4$

Therefore the *n*th round winners is $= \left((n-1)^{th} \text{ winner}\right)$

(The number of remaining school $\frac{1}{3}$)

= $729 \cdot \left(\frac{1}{3}\right) \cdot \frac{1}{3}$

The $\left(x^4\right)^{th}$ round winner is = $\left((x-1)^{th} \text{ winner}\right)$(After each round only $\frac{1}{3}$ of each schools)

$$= 729\left(\frac{1}{3}\right)^{x-1} \cdot \left(\frac{1}{3}\right)^1$$

$$= 729\left(\frac{1}{3}\right)^x$$

Hence, the number of schools remaining after *x* rounds is $\boxed{s(x) = 729\left(\frac{1}{3}\right)^x}$

Therefore, the number of school remaining after '*x*' round is $729\left(\frac{1}{3}\right)^x$

Step2: Solve for 'x'.

In a school competition winner is only one school,

Now, substitute $s(x)=1$ is the original function

$$s(x)=729\left(\frac{1}{3}\right)^x \qquad (\text{we obtain the } x \text{ value})$$

$$1=\frac{729}{729}\left(\frac{1}{3}\right)^x \qquad (\text{Divide 729 on each side})$$

$$\frac{1}{729}=\left(\frac{1}{3}\right)^x$$

$$\log_{10}\left(\frac{1}{729}\right)=\log_{10}\left(\frac{1}{3}\right)^x \qquad (\text{Taking } \log_{10} \text{ on both sides})$$

$$\log_{10}\left(\frac{1}{729}\right)=x\cdot\log_{10}\frac{1}{3} \qquad (\text{Use the rule } \log_{10}a^n=m\log_{10}a)$$

$$\frac{\log_{10}\left(\frac{1}{729}\right)}{\log_{10}\frac{1}{3}}=x \qquad (\text{Solve for } x)$$

$$\boxed{x=6}$$

Hence, after $\boxed{x=6}$ rounds it will take to declare a champion.

Answer 40PA.

A runner is training for a marathon, running a total of 20 miles per week on a regular basis.

She plans to increase the distance *D(x)* in miles according to the function $D(x)=20(1\cdot1)^x$ where 'x' represents the number of weeks of training.

Claim: According to the function to find the distance in miles in the week of 1,2,3 and 4.

Step1: To find the distance (miles) in the first week

Now, substitute *x* = 1 in the original function

$$D(x)=20(1.1)^x$$

$$D(1)=20(1.1)^1 \qquad (\text{Replace } x \text{ by } 1)$$

$$D(1)=20(1.1)$$

$$D(1)=22$$

Hence, she is running $\boxed{22\text{ miles}}$ in 1st week

Step2: To find the distance (miles) in the second week

Now, substitute $x = 2$ in the original function

$$D(x) = 20(1.1)^x$$
$$D(2) = 20(1.1)^2 \qquad (\text{Replace } x \text{ by } 2)$$
$$D(2) = 24.2$$

Hence, she is running $\boxed{24.2 \text{ miles}}$ in 2nd week.

Step3: To find the distance (miles) in the third week

Now, substitute $x = 3$ in the original function

$$D(x) = 20(1.1)^x$$
$$D(3) = 20(1.1)^3 \qquad (\text{Replace } x \text{ by } 3)$$
$$D(3) = 20(1.331)$$
$$D(3) = 26.62$$

Hence, she is running $\boxed{26.62 \text{ miles}}$ in 3rd week.

Step4: To find the distance (miles) in the fourth week

Now, substitute $x = 4$ in the original function

$$D(x) = 20(1.1)^x$$
$$D(4) = 20(1.1)^4 \qquad (\text{Replace } x \text{ by } 4)$$
$$D(4) = 20(1.4641)$$
$$D(4) = 29.282$$

Hence, she is running $\boxed{29.282 \text{ miles}}$ in 4th week.

Step5: To construct the table

Week	distance(Miles)
1	22
2	24.2
3	26.62
4	29.282

Answer 41PA.

A runner is training for a marathon, running a total of 20 miles per week on a regular basis. She plans to increase the distance *D(x)* in miles according to the function $D(x) = 20(1\cdot1)^x$ where '*x*' represents the number of weeks of training.

Claim: According to the function to find the distance in miles in the week of 1, 2, 3 and 4.

Step1; To find, what is the week that total will be 50 miles or more

Now, substitute $D(x) = 50$ in the original function

$$D(x) = 20(1.1)^x$$

$$D(x) = 20(1.1)^x \qquad \text{(original equation)}$$

$$50 = 20(1.1)^x \qquad (\text{Replace } D(x) \text{ by } 50)$$

$$\frac{50}{20} = \frac{20}{20}(1.1)^x \qquad \text{(Divide 20 on both sides)}$$

$$\frac{50}{20} = (1.1)^x$$

$$\log_{10}\left(\frac{50}{20}\right) = \log_{10}(1.1)^x \qquad (\text{taking } \log_{10} \text{ on both sides})$$

$$x = \frac{\log_{10}\left(\frac{50}{20}\right)}{\log_{10}(1.1)^x}$$

$$= 9.61$$

$$\approx 10$$

Hence, she is running 50 miles or more in $\boxed{10^{th} \text{ week}}$

Answer 42PA.

Consider the graph $y=\left(\frac{1}{5}\right)^x$

Claim: Graph the function $y=\left(\frac{1}{5}\right)^x$ as a transformation of the graph of $y=5^x$

Step1: Graph the function $y=5^x$

To construct the table for $y=5^x$

Now, substitute the different value of *x* in the original function $y=5^x$, we obtained pairs and connect them we get a smooth curve

Take for $y=5^x$

x	5^x	y	(x,y)
-3	$5^{-3}=0.008$	0.008	$(-3,0.008)$
-2	$5^{-2}=0.04$	0.04	$(-2,0.04)$
-1	$5^{-1}=0.2$	0.2	$(-1,0.2)$
0	$5^0=1$	1	$(0,1)$
1	$5^1=5$	5	$(1,5)$
2	$5^2=25$	25	$(2,25)$

Step2: graph the function $y=\left(\frac{1}{5}\right)^x$

To construct the table for $y=\left(\frac{1}{5}\right)^x$

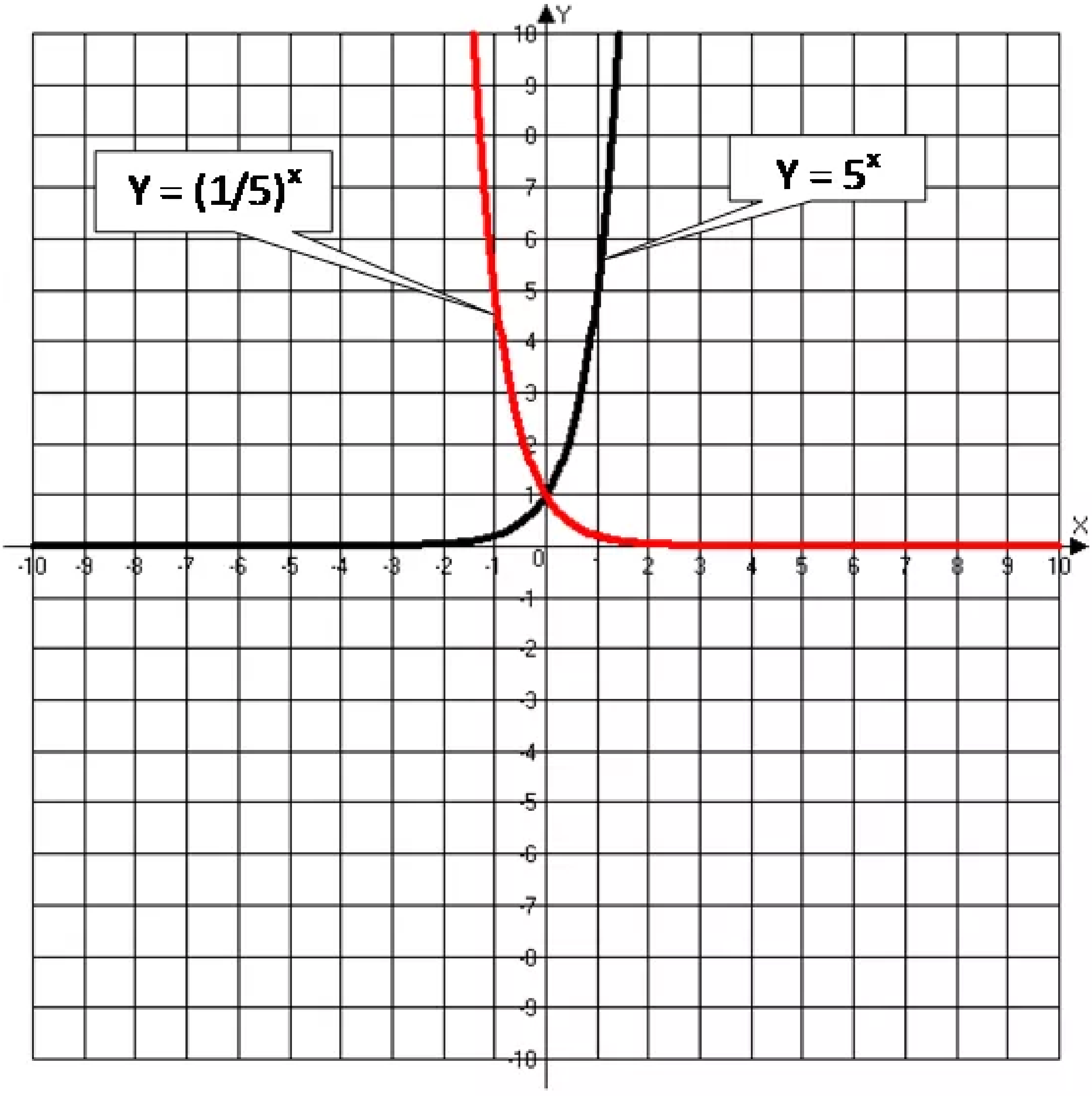
Now, substitute the different values of '*x*' in the original function $y=\left(\frac{1}{5}\right)^x$ we obtain *y* values.

Plotting these all ordered pairs and connect them we obtain the smooth curve

Table for $y=\left(\frac{1}{5}\right)^x$

x	$\left(\frac{1}{5}\right)^x$	y	(x,y)
-3	$\left(\frac{1}{5}\right)^{-3}=125$	125	$(-3,125)$
-2	$\left(\frac{1}{5}\right)^{-2}=25$	25	$(-2,25)$
-1	$\left(\frac{1}{5}\right)^{-1}=5$	5	$(-1,5)$
0	$\left(\frac{1}{5}\right)^{0}=1$	1	$(0,1)$
1	$\left(\frac{1}{5}\right)^{1}=0.2$	0.2	$(1,0.2)$
2	$\left(\frac{1}{5}\right)^{2}=0.04$	0.04	$(2,0.04)$
3	$\left(\frac{1}{5}\right)^{3}=0.008$	0.008	$(2,0.008)$

Step3: To describe the graph $y = \left(\frac{1}{5}\right)^x$ as a transformation of the graph $y = 5^x$



We observe that, the graph $y = \left(\frac{1}{5}\right)^x$ is wider 2 units of the graph $y = y^x$

Answer 43PA.

Consider the graph $y = 5^x + 2$

Claim: Graph the function $y = 5^x + 2$ as a transformation of the graph of $y = 5^x$

Step1: Graph the function $y = 5^x$

To construct the table for $y = 5^x$

Now, substitute the different value of *x* in the original function $y = 5^x$, we obtained pairs and connect them we get a smooth curve

Take for $y = 5^x$

x	5^x	y	(x, y)
-3	$5^{-3} = 0.008$	0.008	$(-3, 0.008)$
-2	$5^{-2} = 0.04$	0.04	$(-2, 0.04)$
-1	$5^{-1} = 0.2$	0.2	$(-1, 0.2)$
0	$5^0 = 1$	1	$(0, 1)$
1	$5^1 = 5$	5	$(1, 5)$
2	$5^2 = 25$	25	$(2, 25)$
3	$5^3 = 125$	125	$(3, 125)$

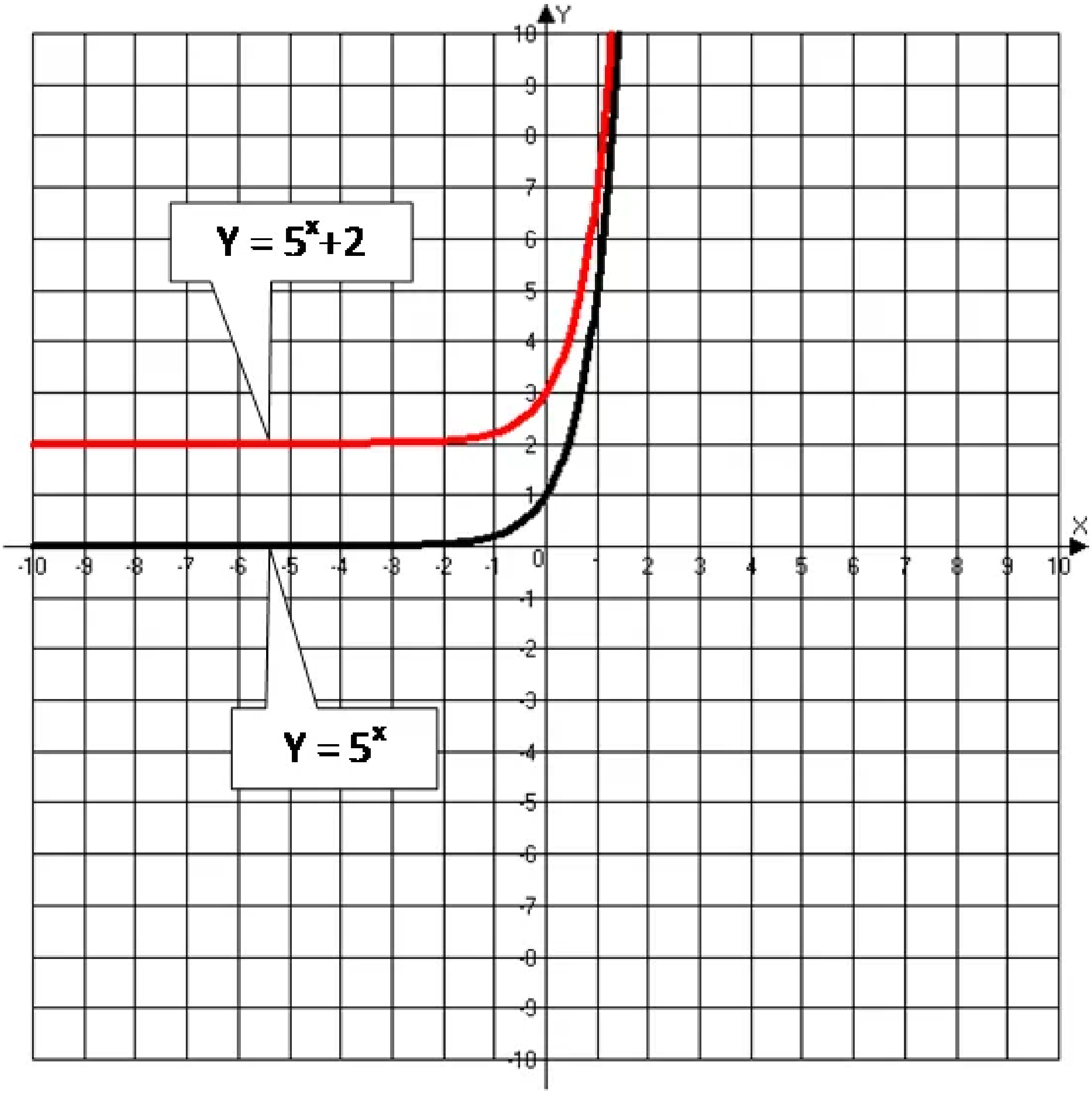
Step2: graph the function $y = 5^x + 2$

To construct the table for $y = 5^x + 2$

Now, substitute the different values of '*x*' in the original function $y = 5^x + 2$ we obtain *y* - values. Plotting these all ordered pairs and connect them we obtain the smooth curve

x	$5^x + 2$	y	(x, y)
-3	$5^{-3} + 2 = 2.008$	2.008	$(-3, 2.008)$
-2	$5^{-2} + 2 = 2.04$	2.04	$(-2, 2.04)$
-1	$5^{-1} + 2 = 2.2$	2.2	$(-1, 2.2)$
0	$5^0 + 2 = 3$	3	$(0, 3)$
1	$5^1 + 2 = 7$	7	$(1, 7)$
2	$5^2 + 2 = 27$	27	$(2, 27)$
3	$5^3 + 2 = 127$	127	$(2, 127)$

Step3: To describe the graph $y = 5^x + 2$ as a transformation of the graph $y = 5^x + 2$



We observe that, the graph $y = 5^x + 2$ is wider 2 units of the graph $y = 5^x$

Answer 44PA.

Consider the graph $y = 5^x - 4$

Claim: Graph the function $y = 5^x - 4$ as a transformation of the graph of $y = 5^x$

Step1: Graph the function $y = 5^x$

To construct the table for $y = 5^x$

Now, substitute the different value of *x* in the original function $y = 5^x$, we obtained pairs and connect them we get a smooth curve

Take for $y = 5^x$

x	5^x	y	(x, y)
-3	$5^{-3} = 0.008$	0.008	$(-3, 0.008)$
-2	$5^{-2} = 0.04$	0.04	$(-2, 0.04)$
-1	$5^{-1} = 0.2$	0.2	$(-1, 0.2)$
0	$5^0 = 1$	1	$(0, 1)$
1	$5^1 = 5$	5	$(1, 5)$
2	$5^2 = 25$	25	$(2, 25)$
3	$5^3 = 125$	125	$(3, 125)$

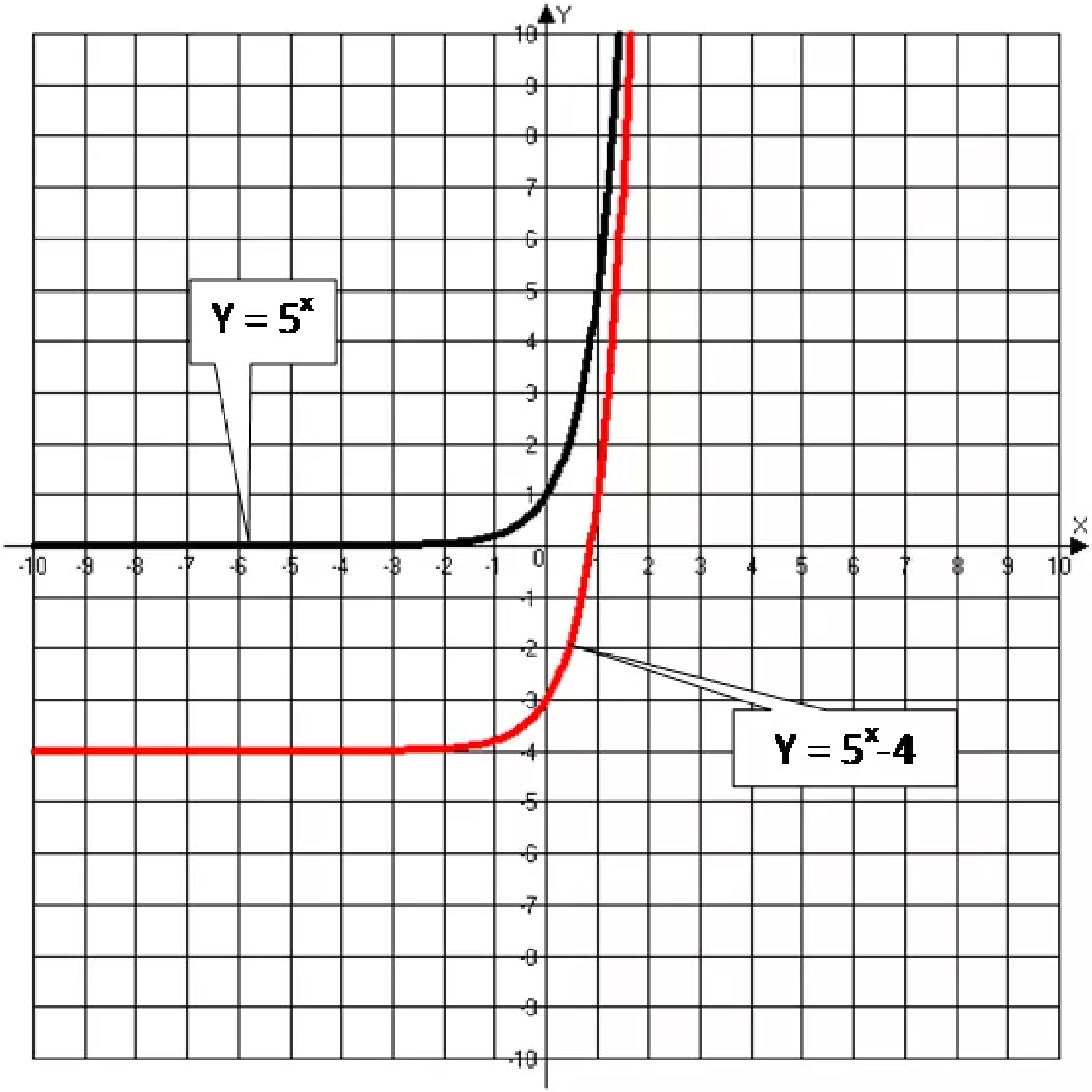
Step2: graph the function $y = 5^x - 4$

To construct the table for $y = 5^x - 4$

Now, substitute the different values of '*x*' in the original function $y = 5^x - 4$ we obtain *y* - values. Plotting these all ordered pairs and connect them we obtain the smooth curve

x	$5^x - 4$	y	(x, y)
-3	$5^{-3} - 4 = -3.992$	-3.992	$(-3, -3.992)$
-2	$5^{-2} - 4 = -3.8$	-3.8	$(-2, -3.8)$
-1	$5^{-1} - 4 = -3.8$	-3.8	$(-1, -3.8)$
0	$5^0 - 4 = -3$	-3	$(0, -3)$
1	$5^1 - 4 = 1$	1	$(1, 1)$
2	$5^2 - 4 = 21$	21	$(2, 21)$
3	$5^3 - 4 = 121$	121	$(2, 121)$

Step3: To describe the graph $y = 5^x - 4$ as a transformation of the graph $y = 5^x - 4$



We observe that, the graph $y = 5^x - 4$ is wider 4 units down to the function $y = 5^x$

Answer 45PA.

If the number of items on each level of a piece of art is a given number times the number of items on the previous level, an exponential function can be used to describe the situation, Answer should inside the following.

- For the carving of the pliers, $y = 2^x$
- For this situation, *x* is an integer between 0 and 8 inclusive. The values of *y* are 1, 2, 4, 8, 16, 32, 64, 128 and 256.

Answer 46PA.

Look at the choice of $f(x) = x^2, f(x) = x^5$ and $f(x) = x^3 + 2x^2 - x + 5$ is polynomial function. To remove the choice *A*, *C* and *D*.

Therefore the exponential function is $f(x) = 6^x$

Hence Answer $\boxed{B}$

Consider the function $y = 2^x$ and $y = 6^x$

Step1: Graph the function $y = 2^x$

To construct the table for $y = 2^x$

Now, substitute the different value of *x* in the original function $y = 2^x$, we obtained the *y* – values.

Plotting these all ordered pairs and connected them we obtain the smooth curve

Take for $y = 2^x$

x	2^x	y	(x, y)
-4	$2^{-4} = 0.0625$	0.0625	$(-4, 0.0625)$
-3	$2^{-3} = 0.125$	0.125	$(-3, 0.125)$
-2	$2^{-2} = 0.25$	0.25	$(-2, 0.25)$
-1	$1^{-1} = 0.5$	0.5	$(-1, 0.2)$
0	$2^0 = 1$	1	$(0, 1)$
1	$2^1 = 2$	2	$(1, 2)$
2	$2^2 = 4$	4	$(2, 4)$
3	$2^3 = 8$	8	$(3, 8)$
4	$2^4 = 16$	16	$(3, 16)$

Answer 47PA.

Step2: graph the function $y = 6^x$

To construct the table for $y = 6^x$

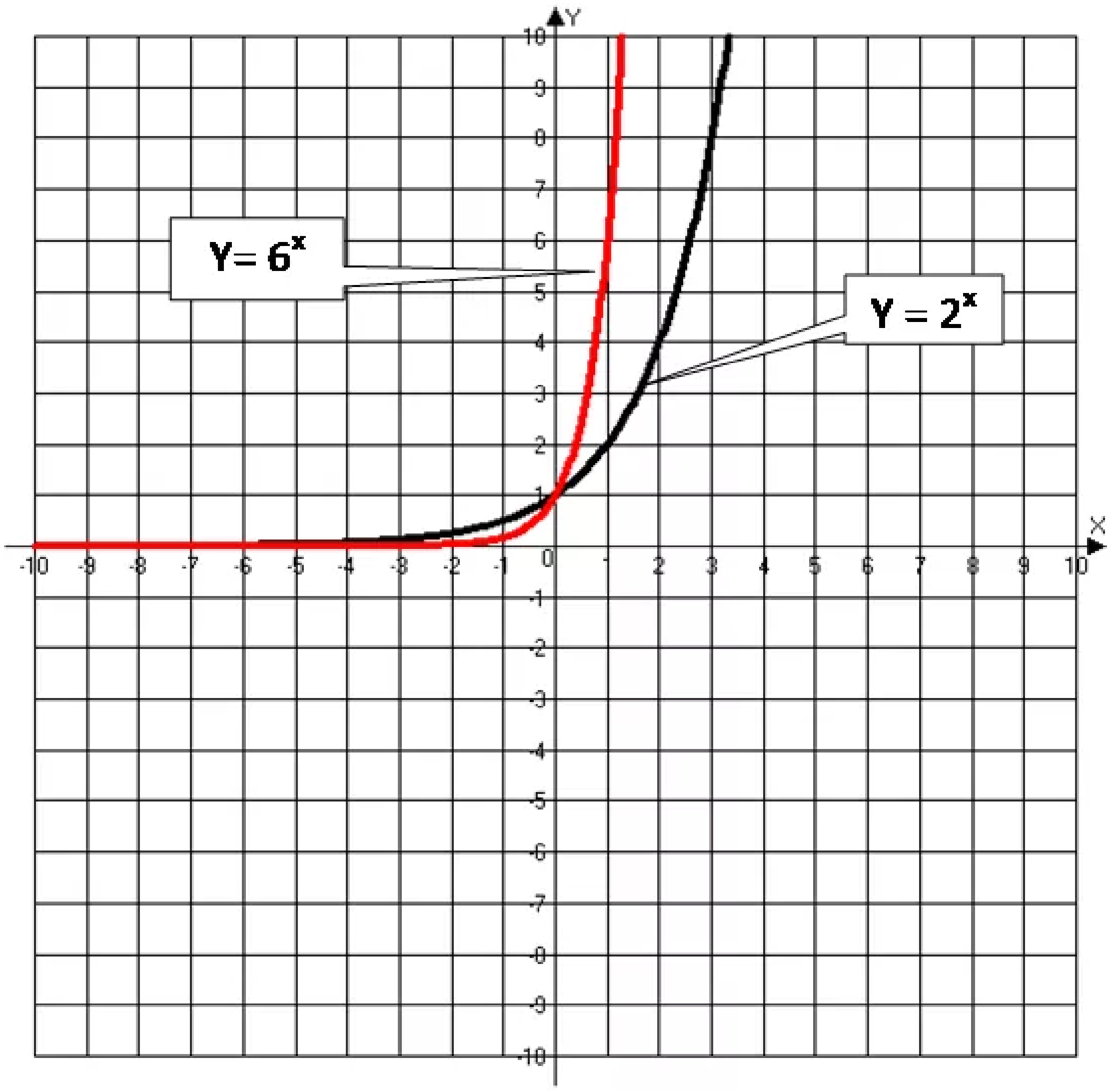
Now, substitute the different values of 'x' in the original function $y = 6^x$ we obtain y - values.

Plotting these all ordered pairs and connect them we obtain the smooth curve

x	6^x	y	(x, y)
-3	$6^{-3} = 0.0046$	0.0046	$(-3, 0.0046)$
-2	$6^{-2} = 0.0278$	0.0278	$(-2, 0.0278)$
-1	$6^{-1} = 0.1667$	0.1667	$(-1, 0.1667)$
0	$6^0 = 1$	1	$(0, 1)$
1	$6^1 = 6$	6	$(1, 6)$
2	$6^2 = 36$	36	$(2, 36)$

Step3: The graph of $y = 6^x$ is greater than the graph of $y = 2^x$

Answer $\boxed{A}$



Answer 48PA.

Consider the equation $x^2 - 9x - 36 = 0$

Claim: Solve the equation $x^2 - 9x - 36 = 0$

Now compare the equation $x^2 - 9x - 36 = 0$ with the standard form of the quadratic equation

$ax^2 + bx + c = 0$. We obtain $a = 1, b = -9$ and $c = -36$

Use the formula

The solution of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(1)(-36)}}{2(1)} \quad [\text{Replace } b = -9, c = -36 \text{ and } a = 1]$$

$$= \frac{9 \pm \sqrt{81 + 144}}{2}$$

$$= \frac{9 \pm \sqrt{225}}{2}$$

$$= \frac{9 \pm 15}{2}$$

$$x = \frac{9+15}{2} \quad \text{or} \quad x = \frac{9-15}{2}$$

$$x = \frac{24}{2} \quad \text{or} \quad x = \frac{-6}{2}$$

$$x = 12 \quad \text{or} \quad x = -3$$

Therefore, the solution set is $\boxed{\{-3, 12\}}$

Answer 49PA.

Consider the equation $2t^2+3t-1=0$

Claim: Solve the equation $2t^2+3t-1=0$

Now compare the equation $2t^2+3t-1=0$ with the standard form of the quadratic equation $ax^2+bx+c=0$. We obtain $a=2, b=3$, $c=-1$ and $x=t$

Use the formula

The solution of the quadratic equation $ax^2+bx+c=0$ where $a \neq 0$ are given by the quadratic formula $x=\frac{-b \pm \sqrt{b^2-4ac}}{2a}$.

$$x=\frac{-b \pm \sqrt{b^2-4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$x=\frac{-3 \pm \sqrt{(3)^2-4(2)(-1)}}{2(2)} \qquad [\text{Replace } b=3, c=-1 \text{ and } a=2]$$

$$=\frac{-3 \pm \sqrt{9+8}}{4}$$

$$=\frac{3 \pm \sqrt{17}}{4}$$

$$=\frac{-3 \pm 4.1}{4} \qquad [\sqrt{17}=4.1]$$

$$x=\frac{-3+4.1}{4} \quad \text{or} \quad x=\frac{-3-4.1}{4}$$

$$x \approx \frac{1.1}{42} \quad \text{or} \quad x \approx \frac{-7.1}{4}$$

$$x \approx 0.3 \quad \text{or} \quad x \approx -1.8$$

Therefore, the solution set is $\boxed{\{-1.8, 0.3\}}$

Answer 50MYS.

Consider the equation $5y^2+3=y$

Claim: Solve the equation $5y^2+3=y$

Step 1: Rewrite the equation $5y^2+3=y$ in standard form of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$

$$5y^2+3=y \quad \text{[original equation]}$$
$$5y^2+3-y=y-y \quad \text{[Substract "}y\text{" on both sides]}$$
$$5y^2-y+3=0$$

Step 2: Now solve the equation $5y^2-y+3=0$ compare the equation $5y^2-y+3$ with the standard form of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ we obtain $a=5, b=-1$ and $c=3$ and $x=y$

Use the formula

The solution of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$.

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$
$$x=\frac{-(-1)\pm\sqrt{(-1)^2-4(5)(3)}}{2(5)} \quad [\text{Replace } a=5, b=-1 \text{ and } c=3 \text{ and } x=y]$$
$$=\frac{-1\pm\sqrt{1-60}}{10}$$
$$=\frac{1\pm\sqrt{-59}}{10}$$
$$=\frac{1\pm\sqrt{-1\cdot 59}}{10} \quad \left[\text{Use te rule } \sqrt{ab}=\sqrt{a}\cdot\sqrt{b}\right]$$
$$=\frac{1\pm\sqrt{-1}\cdot\sqrt{59}}{10}$$
$$=\frac{1\pm i\sqrt{59}}{10} \quad \left[\text{use the rule } \sqrt{-1}=i\right]$$

Therefore,

$$y=\frac{1+i\sqrt{59}}{10} \text{ or } y=\frac{1-i\sqrt{59}}{10}$$

The solution set is $\boxed{\left\{\frac{1+i\sqrt{59}}{10}, \frac{1-i\sqrt{59}}{10}\right\}}$

Answer 51MYS.

Consider the equation $x^2 - 7x = -10$

Claim: Solve the equation $x^2 - 7x = -10$

Step 1: Rewrite the equation $x^2 - 7x = -10$ in standard form of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$

$$x^2 - 7x = -10 \quad \text{[original equation]}$$
$$x^2 - 7x + 10 = -10 + 10 \text{[Add "10" on both sides]}$$
$$x^2 - 7x + 10 = 0$$

Step 2: Now solve the equation $x^2 - 7x + 10 = 0$ by factorization

$$x^2 - 7x + 10 = 0 \quad \text{[original equation]}$$
$$x^2 - 5x - 2x + 10 = 0$$
$$x \cdot x - 5 \cdot x - 2 \cdot x + 2 \cdot 5 = 0 \quad \text{[use the distributive property]}$$
$$x(x-5) - 2(x-5) = 0$$
$$(x-5)(x-2) = 0$$
$$x - 2 = 0 \quad \text{or} \quad x - 5 = 0$$
$$x = 2 \quad \text{or} \quad x = 5$$

Therefore, the solution set is $\{2, 5\}$

Answer 52MYS..

Consider the equation $a^2 - 12a = 3$

Claim: Solve the equation $a^2 - 12a = 3$

Step 1: Rewrite the equation $a^2 - 12a = 3$ in standard form of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$

$$a^2 - 12a = 3 \quad \text{[original equation]}$$
$$a^2 - 12a - 3 = 3 - 3 \quad \text{[Substract "3" on both sides]}$$
$$a^2 - 12a - 3 = 0$$

Step 2: Now solve the equation $a^2 - 12a - 3 = 0$ by quadratic formula

Now, compare the equation $a^2 - 12a - 3 = 0$ with the standard form of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$ we obtain $a = 1, b = -12$ and $c = -3$ and $x = a$

Use the formula

The solution of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$ are given by the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$x=\frac{-(-12)\pm\sqrt{(-12)^2-4(1)(-3)}}{2(1)} \quad \begin{bmatrix}\text{Replace } a=1, b=-12\\ \text{and } c=-3 \text{ and } x=a\end{bmatrix}$$

$$=\frac{12\pm\sqrt{144+12}}{2}$$

$$=\frac{12\pm\sqrt{156}}{2}$$

$$\approx\frac{12\pm 12.5}{2} \quad \left[\sqrt{156}\approx 12.5\right]$$

$$a\approx\frac{12+12.5}{2} \quad \text{or} \quad a\approx\frac{12-12.5}{2}$$

$$a\approx\frac{24.5}{2} \quad \text{or} \quad a\approx\frac{-0.5}{2}$$

$$a\approx 12.2 \quad \text{or} \quad a\approx -0.3$$

The solution set is $\boxed{\{-0.3, 12.2\}}$

Answer 53MYS.

Consider the equation $t^2+6t+3=0$

Claim: Solve the equation $t^2+6t+3=0$

Step 1: Solve the equation $t^2+6t+3=0$ by Quadratic formula

Now, compare the equation $t^2+6t+3=0$ with the standard form of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ we obtain $a=1, b=6, c=3$ and $x=t$

Use the formula

The solution of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$.

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$x=\frac{-(6)\pm\sqrt{(6)^2-4(1)(3)}}{2(1)} \quad \begin{bmatrix}\text{Replace } a=1, b=6\\ \text{and } c=3 \text{ and } x=t\end{bmatrix}$$

$$=\frac{-6\pm\sqrt{36-12}}{2}$$

$$=\frac{-6\pm\sqrt{24}}{2}$$

$$=\frac{-6\pm 4.9}{2}$$

$$t\approx\frac{-6+4.9}{2} \quad \text{or} \quad t\approx\frac{-6-4.9}{2}$$

$$t\approx\frac{-1.1}{2} \quad \text{or} \quad t\approx\frac{-10.9}{2}$$

$$t\approx 0.55 \quad \text{or} \quad t\approx 5.45$$

The solution set is $\boxed{\{0.55, 5.45\}}$

Answer 54MYS.

Consider the trinomial $m^2-14m+40$

<u>Claim:</u> To find the factor of $m^2-14m+40$

$$\begin{aligned} m^2-14m+40 &= m^2-10m-4m+40 \\ &= m\cdot m-10\cdot m-4\cdot m-4(-10) \\ &= m(m-10)-4(m-10) \qquad [\text{use distributive property}] \end{aligned}$$

$$m^2-14m+40=(m-4)(m-10)$$

The factors of $m^2-14m+40$ is $\boxed{(m-4)(m-10)}$

Answer 55MYS.

Consider the trinomial $t^2-2t+35$

<u>Claim:</u> To find the factor of $t^2-2t+35$

$$\begin{aligned} t^2-2t+35 &= t^2-2\cdot t\cdot 1+35 \\ &= t\cdot t-2\cdot t\cdot 1-1^2-1^2+35 \\ &= (t-1)^2+34 \qquad [\text{use the rule}; a^2-2ab+b^2=(a-b)^2] \\ &= (t-1)^2+\left(\sqrt{34}\right)^2 \end{aligned}$$

$$t^2-2t+35=(t-1)^2+\left(\sqrt{34}\right)^2$$

Therefore, the trinomial $t^2-2t+35$ cannot be factorial using integers.

Hence, $t^2-2t+35$ is $\boxed{\text{prime}}$

Answer 56MYS.

Consider the trinomial $z^2-5z-24$

<u>Claim:</u> To find the factor of $z^2-5z-24$

$$\begin{aligned} z^2-5z-24 &= z^2-2\cdot z\cdot\frac{5}{2}-24 \\ &= t^2-2\cdot z\cdot\frac{5}{2}+\left(\frac{5}{2}\right)^2-\left(\frac{5}{2}\right)^2-24 \\ &= z^2-5z+\frac{25}{4}-\frac{25}{4}-24 \\ &= \left(z-\frac{5}{2}\right)^2-\frac{121}{4} \qquad [\text{use the rule}; a^2-2ab+b^2=(a-b)^2] \end{aligned}$$

$$z^2-5z-24=\left(z-\frac{5}{2}\right)^2-\frac{121}{4}$$

Therefore, the trinomial $z^2-5z-24$ cannot be factorial using integers.

Hence, $z^2-5z-24$ is $\boxed{\text{prime}}$

Answer 57MYS.

Let ‘x’ be the first number

And ‘y’ be the second number

Step 1:- According to the problem three times one number equal to twice second number

$$3 \times x = 2 \times y$$
$$3x = 2y$$

Step 2: According to the problem

Twice the first number is 3 more than the second number

$$2 \times x = 3 + y$$
$$2x = 3 + y$$

Step 3: To find ‘x’ value

Now substitute $y = 2x - 3$ in $3x = 2y$

$$3x = 2y \quad \text{[original equation]}$$
$$3x = 2(2x-3) \quad \text{[Replace } y \text{ by } 2x-3\text{]}$$
$$3x = 4x - 6 \quad \text{[Subtract '}4x\text{' on both sides]}$$
$$3x - 4x = 4x - 6 - 4x$$
$$-1x = -6$$
$$x = \boxed{6}$$

Step 4: To find y

Substitute $x = 6$ in $y = 2x - 3$

$$y = 2x - 3 \quad \text{[original equation]}$$
$$y = 2(6) - 3 \quad \text{[Replace } x \text{ by 6]}$$
$$y = 12 - 3$$
$$= 9$$
$$\boxed{y = 9}$$

Therefore, the two numbers is $\boxed{6}$ and $\boxed{9}$

Answer 58MYS.

Consider the inequality $x+7>2$

Claim: Solve the inequality $x+7>2$

$$x+7>2 \quad \text{[original inequality]}$$
$$x+7-7>2-4 \quad \text{[Substract '7' on both sides]}$$
$$x>-5$$

The solution of integral $x+7>2$ is $\boxed{x>-5}$

Hence, the solution set is $\{x \mid x>-5\}$

Answer 59MYS.

Consider the inequality $10 \geq x+8$

Claim: Solve the inequality $10 \geq x+8$

$$10 \geq x+8 \quad \text{[original inequality]}$$
$$-8+10 \geq x+8-8 \quad \text{[Substract '8' on both sides]}$$
$$2 \geq x$$

The solution of integral $10 \geq x+8$ is $2 \geq x \text{ or } x \leq 2$

Hence, the solution set is $\{x \mid x \leq 2\}$

Answer 60MYS.

Consider the inequality $y-7<-12$

Solve the inequality $y-7<-12$

$$y-7<-12 \quad \text{[original inequality]}$$
$$y-7+7<-12+7 \quad \text{[Add '87' on both sides]}$$
$$y<-5$$

The solution of integral $y-7<-12$ is $y-5$

Hence, the solution set is $\{y \mid y<-5\}$

Answer 61MYS.

Consider the formula $p(1+r)^t$

<u>Claim:</u> To determine $p(1+r)^t$ when $p=5, r=\frac{1}{2}$ and $t=2$

Now, we substitute $p=5, r=\frac{1}{2}$ and $t=2$ in $p(1+r)^t$

$$p(1+r)^t = 5\left(1+\frac{1}{2}\right)^2 \qquad \left[\text{Replace } p \text{ by } 5,\ r \text{ by } \frac{1}{2} \text{and } t \text{ by } 2\right]$$

$$= 5(1+0.5)^2$$

$$= 5(1.5)^2$$

$$= 5(2.25)$$

$$= 11.25$$

$p(1+r)^t = 11.25$ when $p=5, r=\frac{1}{2}$ and $t=2$

Hence, the value of $p(1+r)^t$ is $\boxed{11.25}$ when $p=5, r=\frac{1}{2}$ and $t=2$

Answer 62MYS.

Consider the formula $p(1+r)^t$

<u>Claim:</u> To determine $p(1+r)^t$ when $p=300, r=\frac{1}{4}$ and $t=3$

Now, we substitute $p=300, r=\frac{1}{4}$ and $t=3$ in $p(1+r)^t$

$$p(1+r)^t = 300\left(1+\frac{1}{4}\right)^3 \qquad \left[\text{Replace } p \text{ by } 300,\ r \text{ by } \frac{1}{4} \text{ and } t \text{ by } 3\right]$$

$$= 300(1+0.25)^3$$

$$= 300(1.25)^3$$

$$= 300(1.953125)$$

$$\approx 586$$

Therefore, the value of $p(1+r)^t$ is $\boxed{586}$ (approx)

When $p=300, r=\frac{1}{4}$ and $t=3$

Answer 63MYS.

Consider the formula $p(1+r)^t$

Claim: To determine $p(1+r)^t$ when $p=100, r=0.2$ and $t=2$

Now, we substitute $p=100, r=0.2$ and $t=2$ in $p(1+r)^t$

$$\begin{aligned} p(1+r)^t &= 100(1+0.2)^2 \quad [\text{Replace } p \text{ by } 100,\ r \text{ by } 0.2 \text{ and } t \text{ by } 2] \\ &= 100(1.2)^2 \\ &= 100(1.44) \\ &= 144 \end{aligned}$$

Therefore, the value of $p(1+r)^t$ is $\boxed{144}$ when $p=100, r=0.2$ and $t=2$

Answer 64MYS.

Consider the formula $p(1+r)^t$

Claim: To determine $p(1+r)^t$ when $p=6, r=0.5$ and $t=3$

Now, we substitute $p=6, r=0.5$ and $t=3$ in $p(1+r)^t$

$$\begin{aligned} p(1+r)^t &= 6(1+0.5)^3 \quad [\text{Replace } p \text{ by } 6,\ r \text{ by } 0.5 \text{ and } t \text{ by } 3] \\ &= 6(1.5)^3 \\ &= 6(3.375) \\ &= 20.25 \end{aligned}$$

Therefore, the value of $p(1+r)^t$ is $\boxed{20.25}$ when $p=6, r=0.5$ and $t=3$