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14.1

1.

(a) $\frac{2^3}{3^3} = \frac{8}{27}$ (b) $\frac{1}{4^2} = \frac{1}{16}$ (c) $\frac{1}{5}$ ↷ reciprocal

$= 5^2 = 25$

(d) $\frac{4}{3}$ ↷ reciprocal $\frac{3^3}{4^3} = \frac{27}{64}$

2. (a)

x	-3	-2	-1	0	1	2	3
y	0·58	0·69	0·83	1	1·2	1·44	1·728

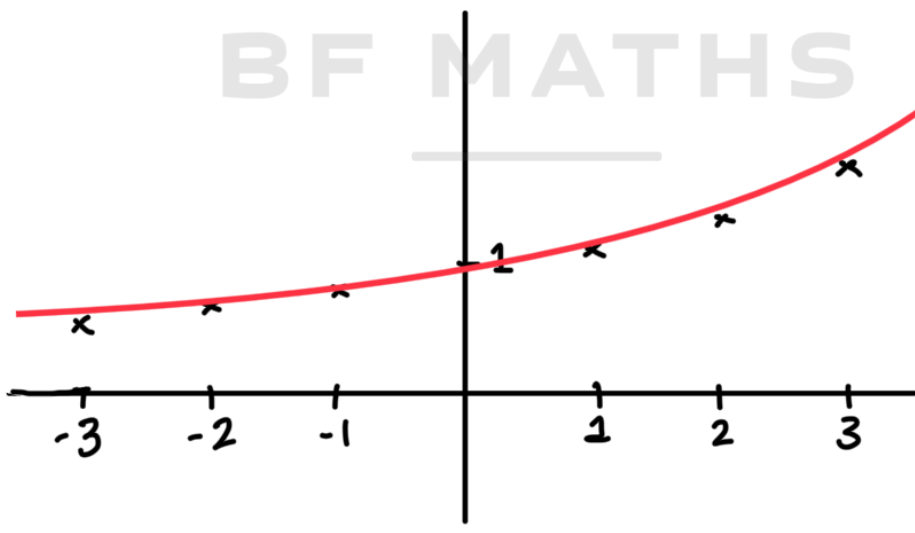
$y = 1 \cdot 2^x$

sub in each value of x

e.g $y = 1 \cdot 2^{-3}$

when $x = -3$, $y = 0 \cdot 58$ (2dp)

(b)



Draw a graph going through the points found in pt (a).

3. (a)

x	-3	-2	-1	0	1	2	3
y	3·375	2·25	1·5	1	0·67	0·44	0·3

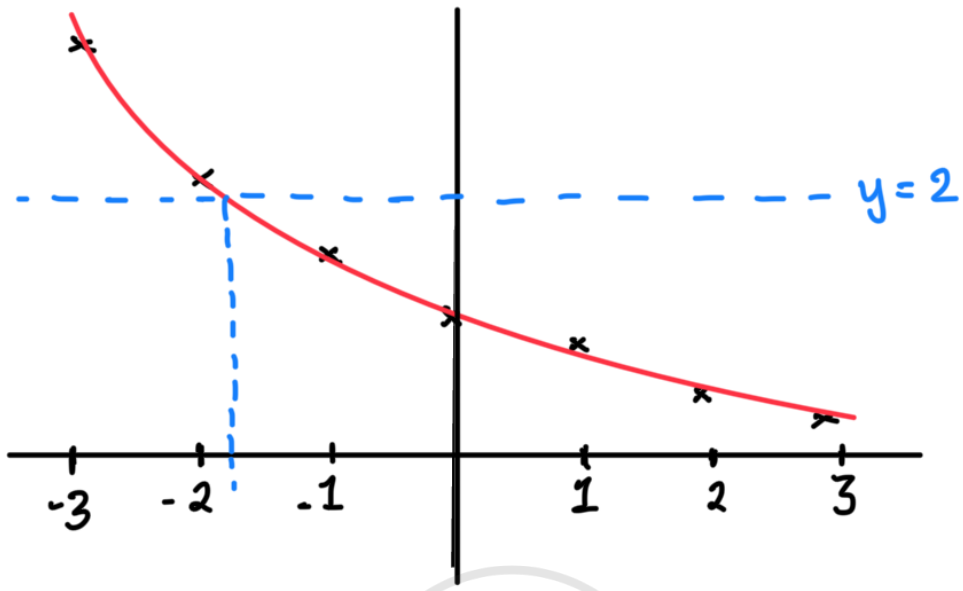
sub x values into equation e.g.

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

$y = \left(\frac{2}{3}\right)^{-3}$

When $x = -3$, $y = 3.375$

(b)

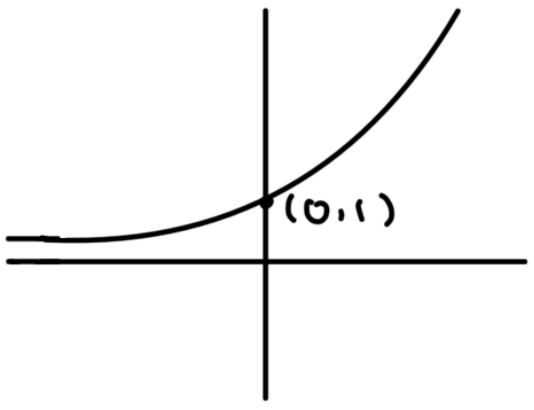


(c) Draw $y = 2$ on your graph and see where it meets.

$x \approx -1.7$

4. (a) $f(x) = 2^x$

Origional graph:

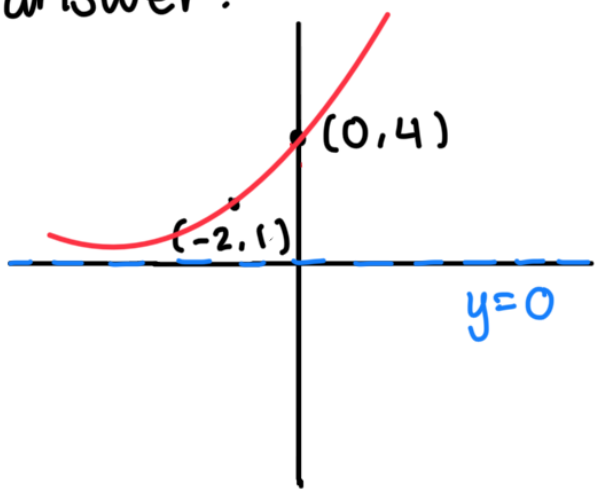


move x coordinate left ↑ by 2.

$f(x+2)$

(0,1) becomes (-2,1)

answer:



$y = 2^x$

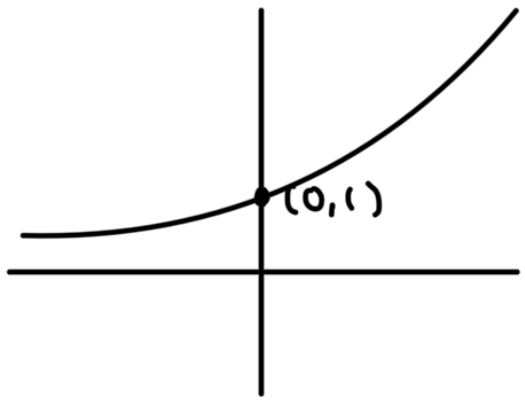
$f(x+2) = 2^{x+2}$

When $x = 0$, $y = 2^{0+2}$

$y = 2^2 = 4$

new co-ordinate is: (0,4)

(b) origional graph:



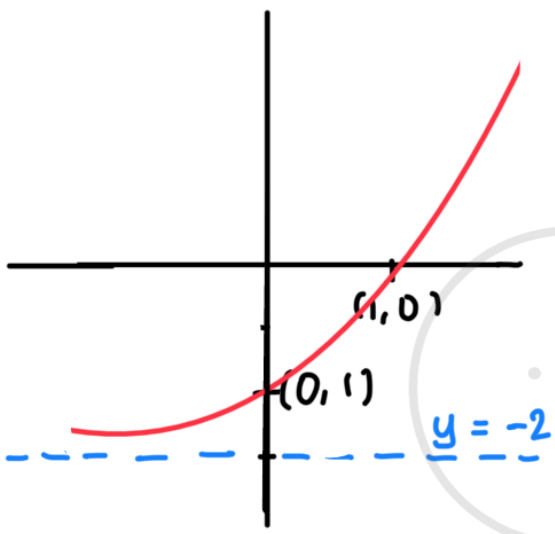
move y coordinate down by 2.

$f(x) - 2$

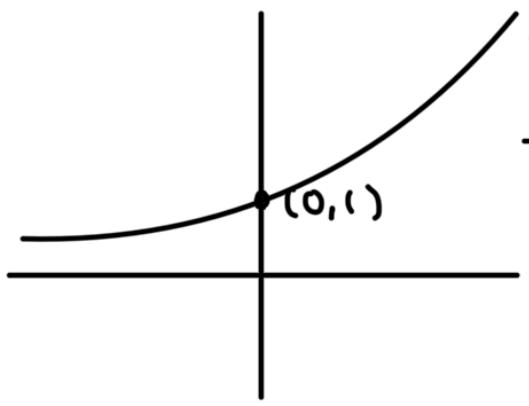
(0,1) becomes (0,-1)

$y = 0$ asymtope becomes $y = -2$

answer:



(c) origional graph:

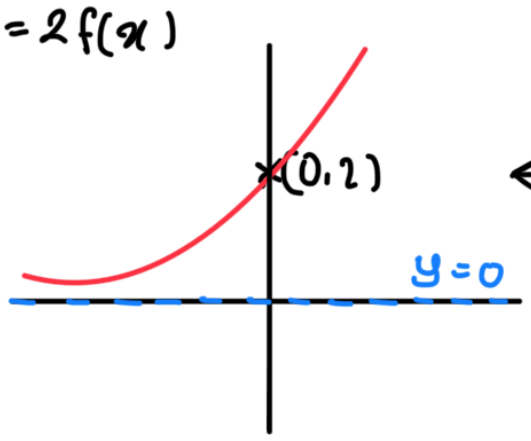


Stretch by 2 multiply y-coordinates by 2.

$2f(x)$

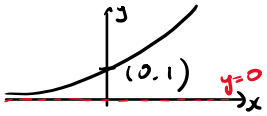
(0,1) becomes (0,2)

$y = 2f(x)$



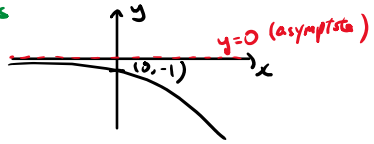
14.1 - Exponential functions

d) Original graph :



reflect in the x-axis

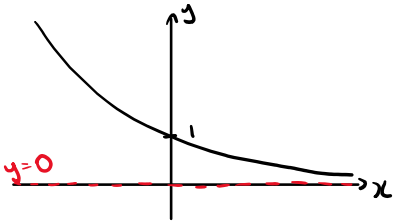
$-f(x)$



5a) $f(x)=\left(\frac{1}{2}\right)^x \rightarrow \left(\frac{1}{2}\right)^x = (2^{-1})^x = 2^{-x}$

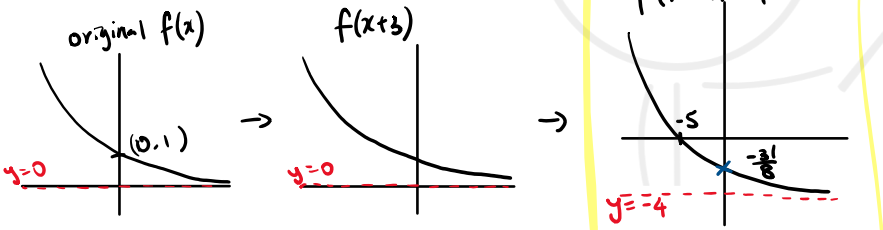
reflection of 2^x in the y-axis

$\because$ If $f(x)=2^x$, then $f(-x)=2^{-x}$



5bi) $f(x+3)-4$ → move down by 4

↓ move left by 3



no effect on sketches

$y=\left(\frac{1}{2}\right)^{x+3}-4$

When $x=0$,

$y=\left(\frac{1}{2}\right)^3-4=-\frac{31}{8}$

not required in this exercise as this will be taught in Chp 14.6

When $y=0$,

$0=\left(\frac{1}{2}\right)^{x+3}-4$

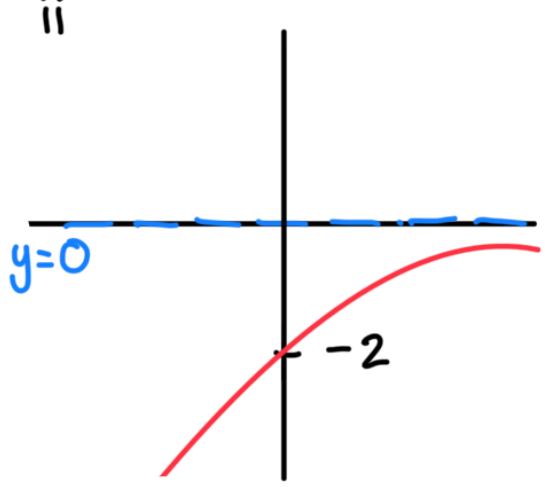
$4=\left(\frac{1}{2}\right)^{x+3}$

$\ln 4=(x+3)\ln\frac{1}{2}$

$x+3=\frac{\ln 4}{\ln\frac{1}{2}}$

$x=\frac{\ln 4}{\ln\frac{1}{2}}-3=-5$

ii



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

Reflection in the x axis.

$y = \ominus 2f(x) = (-2)\left(\frac{1}{2}\right)^x$

when $x = 0$

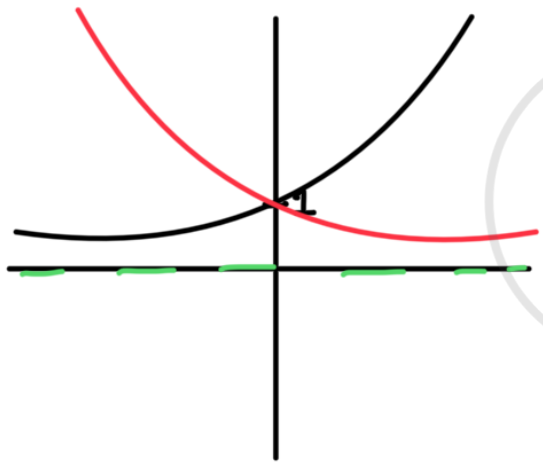
$y = (-2)\left(\frac{1}{2}\right)^0$

$(-2)(1) = -2$

$y = -2$

new coordinate is $(0, -2)$

6. (a)

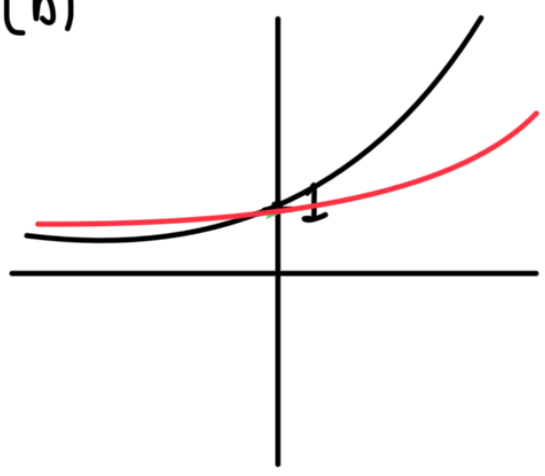


m - answer

Reflection in y axis.

$y = g(\ominus x)$

(b)



$y = g\left(\frac{1}{2}x\right)$

↓

stretch by 2

7. $y = ka^x$

$2 = ka^1$

$128 = ka^{-2}$

$\frac{ka}{ka^{-2}} = a^3$

$$\frac{2}{128} = a^3$$

$$\frac{1}{64} = a^3$$

$a = \frac{1}{4}$] sub $a = \frac{1}{4}$

$$2 = k\left[\frac{1}{4}\right]^1$$

$$2 \div \frac{1}{4} = k$$

$k = 8$