13.3 Notes – The Natural Base e

1) Consider the parent function $f(x) = e^x$

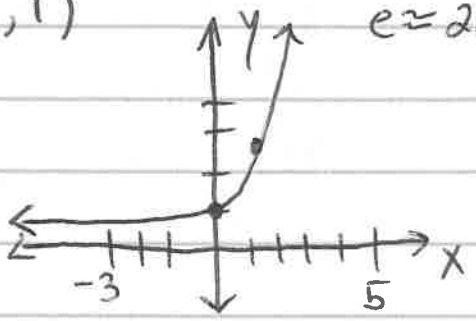
Reference Point is still $(0, 1)$

Another point is $(1, e)$

Domain: $x \in \mathbb{R}$

Range: $y > 0$

H.A. @ $y = 0$



Transformations $y = a \cdot e^{x-h} + K$

2) $H(x) = 2e^{x+4} - 4$

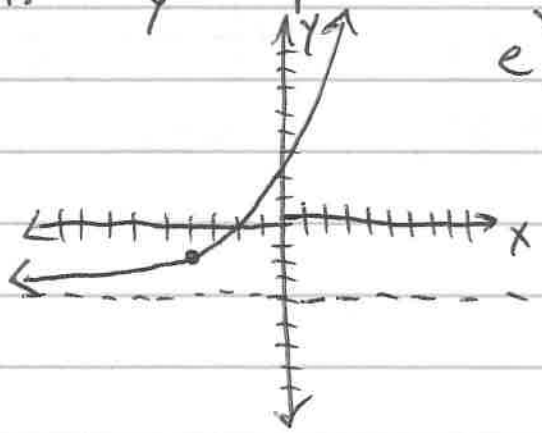
a) Transformations: Left 4, Down 4, vert. stretch by 2

b) $(0, 1) \rightarrow (-4, -2)$

$(x-4, 2y-4)$

c) H.A. $\rightarrow y = -4$

d)



e) Domain $x \in \mathbb{R}$

$-\infty < x < \infty$

Range $y > -4$

3) From 2005-2019, the sales of cell phones in millions of dollars is modeled by the function $S(t) = 116e^{0.18t}$ when $t=0$, year 2005

a) Initial sales amount (2005): 116 million

b) Annual growth rate: $r = 0.18 = 18\%$

c) Effective growth rate: $e^{0.18} \approx 1.197$

$$1.197 - 1 = 0.197 = 19.7\%$$

d) Sales amount in year 2020. $t=15$

$$S(15) = 116e^{0.18(15)}$$

$$\approx 1726 \text{ millions}$$

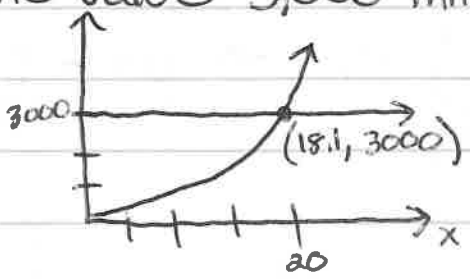
$$1{,}726{,}000{,}000$$

e) what year is the value 3,000 million (3 billion)

$$3000 = 116e^{0.18x}$$

$$x \approx 18.1$$

Year = 2023



4) Given the graph, the equation is of the form $y = ae^{(x-h)} + K$

a) Domain

$-\infty < x < \infty$

b) Range

$y < -6$

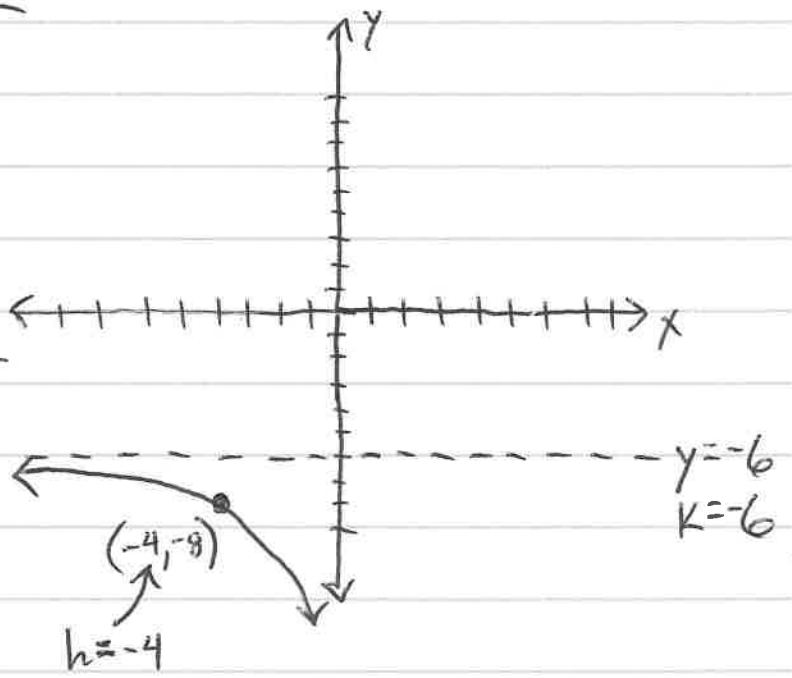
c) Vertical scale factor

$y = ae^{x+4} - 6$

$-8 = ae^{-4+4} - 6$

$-8 = a(1) - 6$

$\boxed{a = -2}$

d) Write the equation

$y = -2e^{x+4} - 6$