

Mat 1375 HW 13

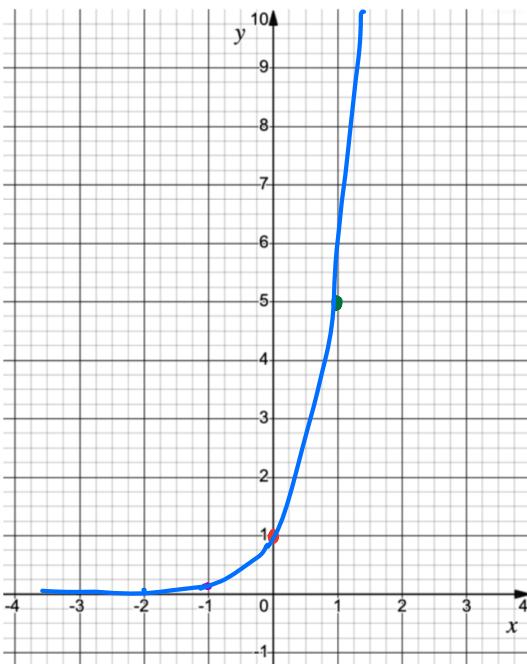
Exercise 13.1

Graph the following functions with the calculator.

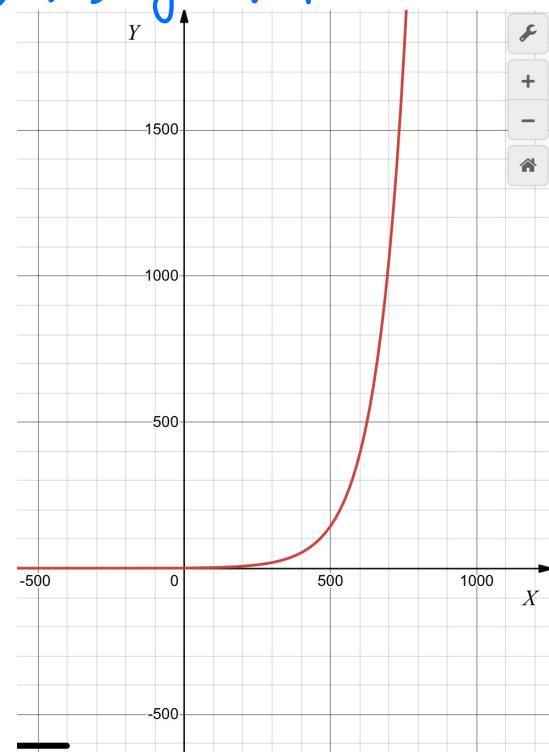
- a) $y = 5^x$
- b) $y = 1.01^x$
- c) $y = (\frac{1}{3})^x$
- d) $y = 0.97^x$
- e) $y = 3^{-x}$
- f) $y = (\frac{1}{3})^{-x}$
- g) $y = e^{x^2}$
- h) $y = 0.01^x$

Sol: a) $f(x) = y = 5^x$

x	$f(x)$
-3	$\frac{1}{125}$
-2	$\frac{1}{25}$
-1	$\frac{1}{5}$
0	1
1	5
2	25
3	125

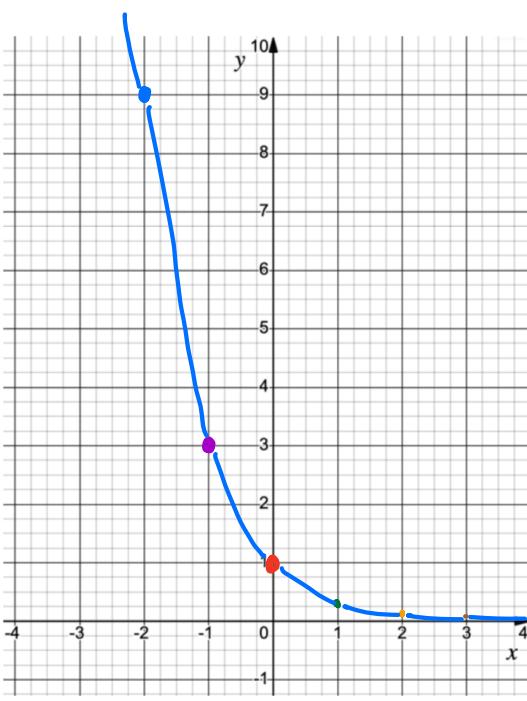


b) $f(x) = y = 1.01^x$

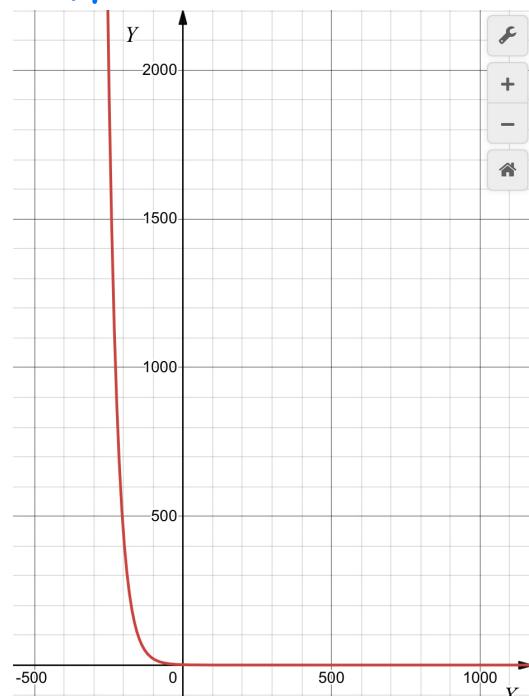


c) $f(x) = y = (\frac{1}{3})^x$

x	$f(x)$
-3	27
-2	9
-1	3
0	1
1	$\frac{1}{3}$
2	$\frac{1}{9}$
3	$\frac{1}{27}$

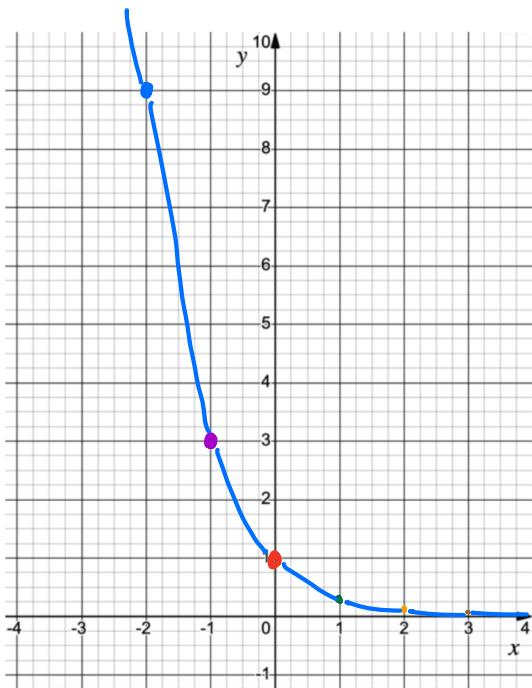


d) $f(x) = y = 0.97^x$



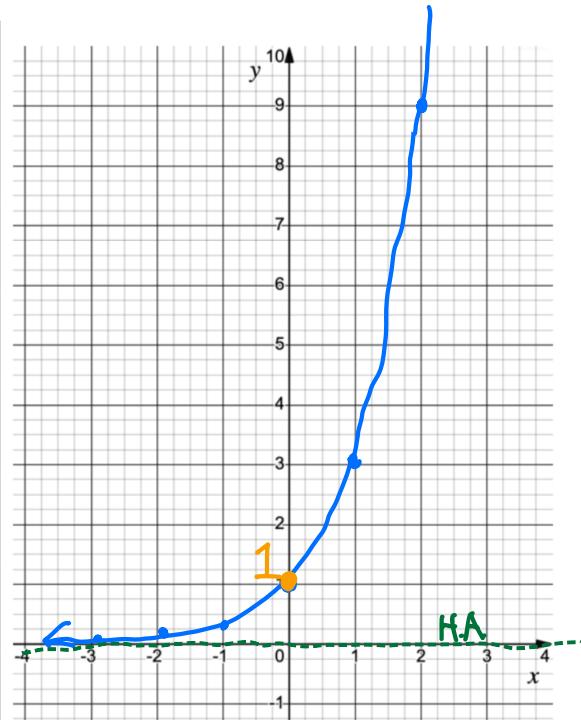
$$e) f(x) = y = 3^x$$

x	$f(x)$
-3	27
-2	9
-1	3
0	1
1	$\frac{1}{3}$
2	$\frac{1}{9}$
3	$\frac{1}{27}$



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

x	$f(x)$
-3	$\frac{1}{27}$
-2	$\frac{1}{9}$
-1	$\frac{1}{3}$
0	1
1	3
2	9
3	27

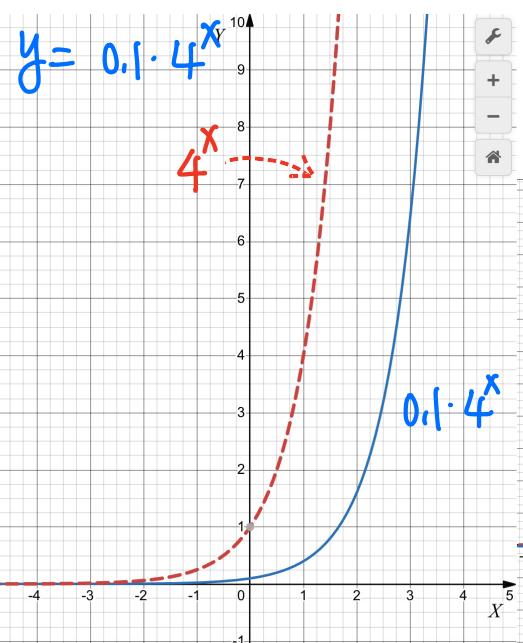


Exercise 13.2

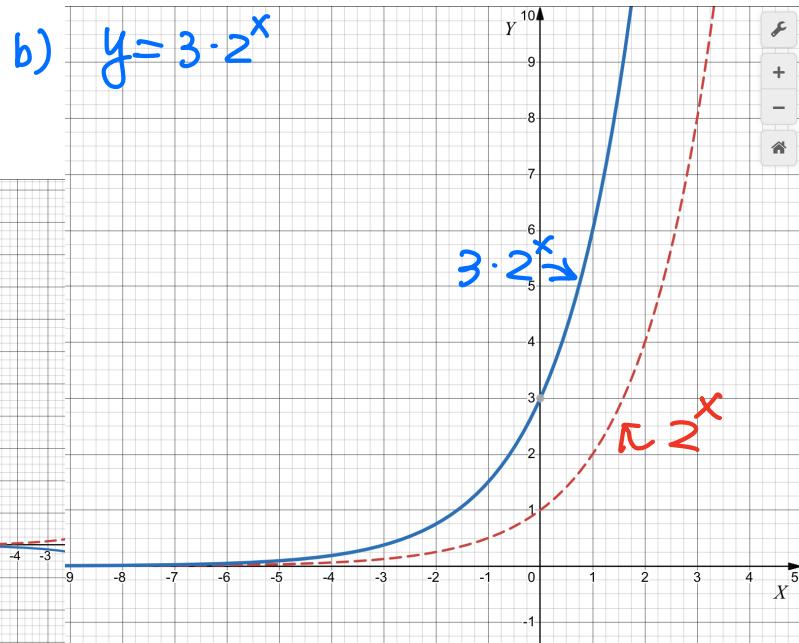
Graph the given function. Describe how the graph is obtained by a transformation from the graph of an exponential function $y = b^x$ (for appropriate base b).

- ✓ a) $y = 0.1 \cdot 4^x$ ✓ b) $y = 3 \cdot 2^x$ ✓ c) $y = (-1) \cdot 2^x$
✓ d) $y = 0.006 \cdot 2^x$ ✓ e) $y = e^{-x}$ f) $y = e^{-x} + 1$

Sol.



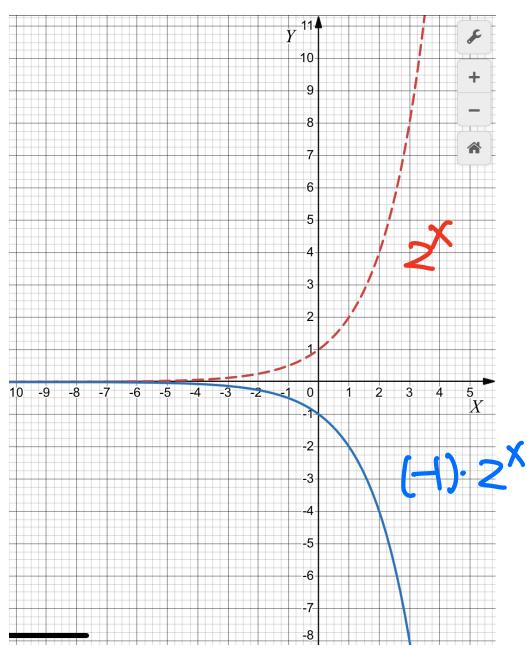
b) $y = 3 \cdot 2^x$



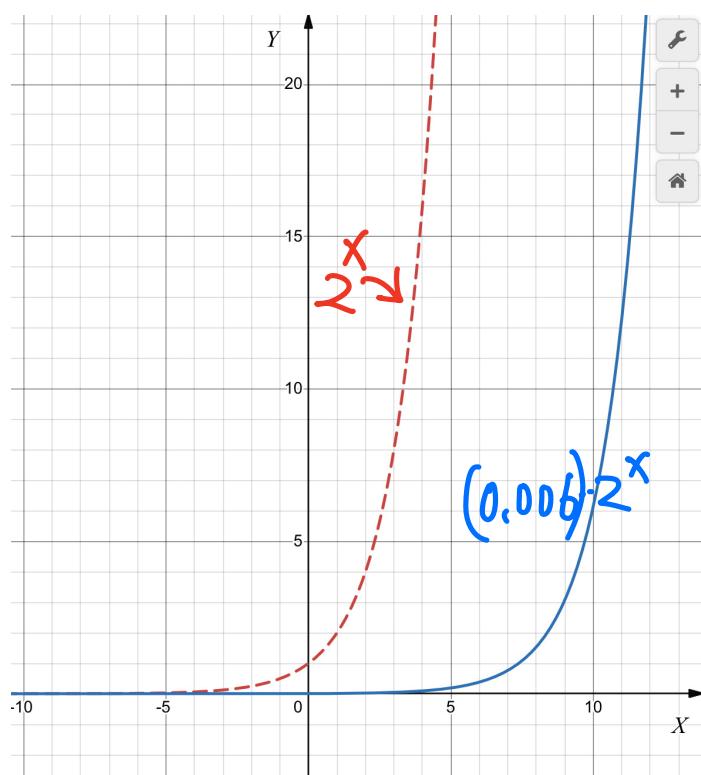
For the same x , the value $0.1 \cdot 4^x$ is $\frac{1}{10}$ of 4^x .

For the same x , the value of $3 \cdot 2^x$ is 3 times of 2^x .

c)



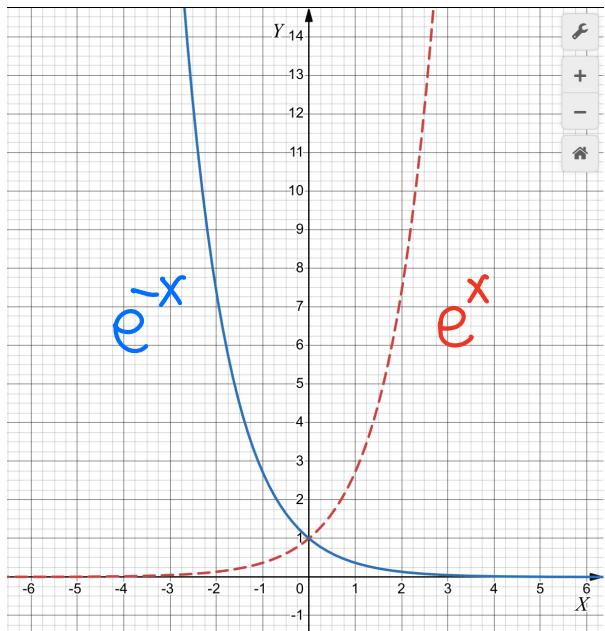
d)



$(-1) \cdot 2^x$ is the graph 2^x

reflecting about x-axis

e)



e^{-x} is the graph e^x reflecting about y-axis.

Exercise 13.4

Evaluate the following expressions *without* using a calculator.

- a) $\log_7(49)$ b) $\log_3(81)$ c) $\log_2(64)$ d) $\log_{50}(2500)$
- e) $\log_2(0.25)$ f) $\log(1000)$ g) $\ln(e^4)$ h) $\log_{13}(13)$
- i) $\log(0.1)$ j) $\log_6\left(\frac{1}{36}\right)$ k) $\ln(1)$ l) $\log_{\frac{1}{2}}(8)$

Sol: a) $\log_7(49) = \log_7(7^2) = 2 \cdot \log_7(7) = 2 \cdot 1 = 2$

b) $\log_3(81) = \log_3(3^4) = 4 \cdot \log_3(3) = 4 \cdot 1 = 4$

$$c) \log_2(64) = \log_2(2^6) = 6 \cdot \log_2(2) = 6 \cdot 1 = 6$$

$$d) \log_{50}(2500) = \log_{50}(50^2) = 2 \cdot \log_{50}(50) = 2 \cdot 1 = 2$$

$$e) \log_2(0.25) = \log_2\left(\frac{1}{4}\right) = \log_2(2^{-2}) = -2 \cdot \log_2(2) = -2 \cdot 1 = -2.$$

$$f) \log(1000) = \log_{10}(10^3) = 3 \cdot \log_{10}(10) = 3 \cdot 1 = 3$$

$$g) \ln(e^4) = 4 \cdot \ln(e) = 4 \cdot 1 = 4$$

$$h) \log_{13}(13) = 1$$

$$i) \log(0.1) = \log_{10}(10^{-1}) = -1 \cdot \log_{10}(10) = -1 \cdot 1 = -1$$

$$j) \log_6\left(\frac{1}{36}\right) = \log_6(6^{-2}) = -2 \cdot \log_6(6) = -2 \cdot 1 = -2$$

$$k) \ln(1) = \ln(e^0) = 0 \cdot \ln(e) = 0 \cdot 1 = 0.$$

$$l) \log_{\frac{1}{2}}(8) = \log_{\frac{1}{2}}\left(\frac{1}{2}^{-3}\right) = -3 \cdot \log_{\frac{1}{2}}\left(\frac{1}{2}\right) = -3 \cdot 1 = -3$$

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

Exercise 13.5

Using a calculator, approximate the following expressions to the nearest thousandth.

$$\begin{array}{llll} a) \log_3(50) & b) \log_3(12) & c) \log_{17}(0.44) & d) \log_{0.34}(200) \\ = 3.560 & = 2.261 & = -0.289 & = -4.911 \end{array}$$

Exercise 13.6

State the domain of the function f and find any vertical asymptote(s) and x -intercept(s). Use the results to sketch the graph.

- a) $f(x) = \log(x)$
- c) $f(x) = \ln(x+5) - 1$
- e) $f(x) = 2 \cdot \log(x+4)$
- g) $f(x) = \log_3(7x+5)$

- b) $f(x) = \log(x+7)$
- d) $f(x) = \ln(3x-6)$
- f) $f(x) = -4 \cdot \log(x+2)$
- h) $f(x) = \ln(-6x+14)$

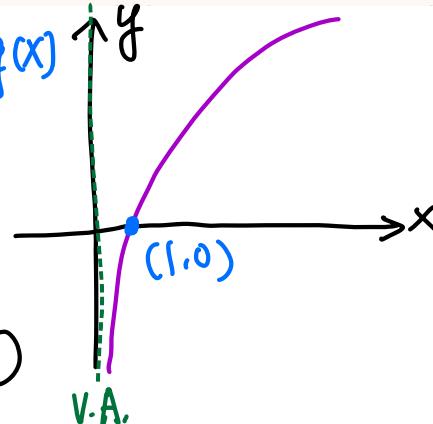
Sol: a) $f(x) = \log(x)$

Domain: $(0, \infty)$

V.A.: $X=0$

x -intercept: $(1, 0)$

(when $f(x)=0 \Rightarrow x=1$)



b) $f(x) = \log(x+7)$ $\Rightarrow x+7 > 0$

Domain: $(-7, \infty)$

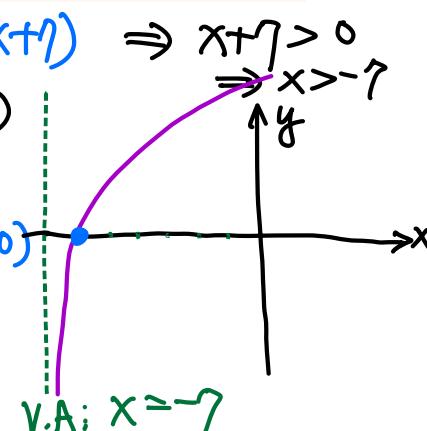
V.A. $X=-7$

x -intercept: $(-6, 0)$

(when $f(x)=0$)

$$\Rightarrow x+7=1$$

$$\Rightarrow x=-6$$



c) $f(x) = \ln(x+5) - 1$ $\Rightarrow x+5 > 0 \Rightarrow x > -5$

Domain: $(-5, \infty)$

V.A. $X=-5$

x -intercept: $(e^{-5}, 0)$

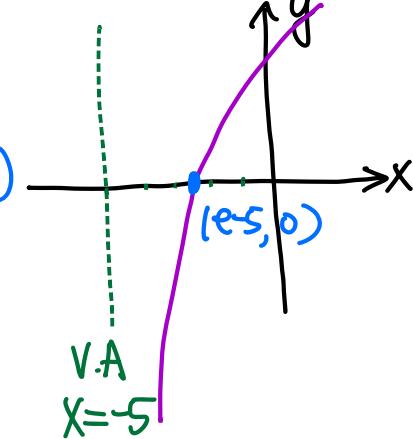
(when $f(x)=0 \Rightarrow$)

$$\ln(x+5)-1=0$$

$$\Rightarrow \ln(x+5)=1$$

$$\Rightarrow x+5=e^1$$

$$\Rightarrow x=e^1-5$$



d) $f(x) = \ln(3x-6)$ $\Rightarrow 3x-6 > 0 \Rightarrow 3x > 6$

Domain: $(2, \infty)$

V.A. $X=2$

x -intercept: $(\frac{7}{3}, 0)$

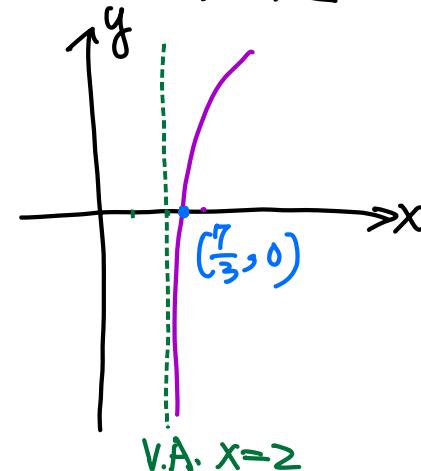
(when $f(x)=0$)

$$\Rightarrow \ln(3x-6)=0$$

$$\Rightarrow 3x-6=1$$

$$\Rightarrow 3x=7$$

$$\Rightarrow x=\frac{7}{3}$$



e) $f(x) = 2 \cdot \log(x+4)$ $\Rightarrow x+4 > 0 \Rightarrow x > -4$

Domain: $(-4, \infty)$

V.A. $X=-4$

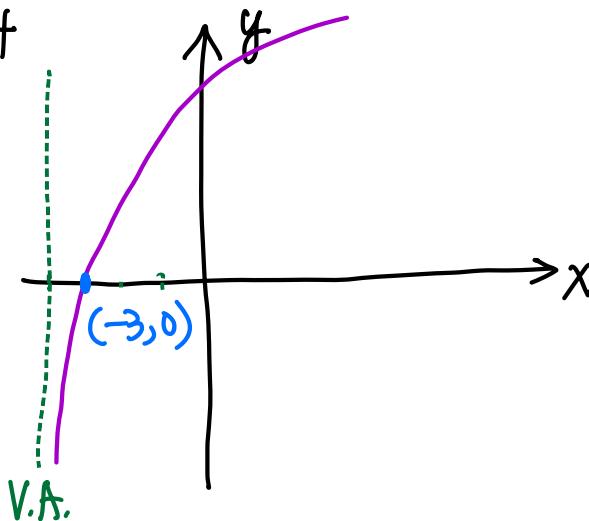
x -intercept: $(-3, 0)$

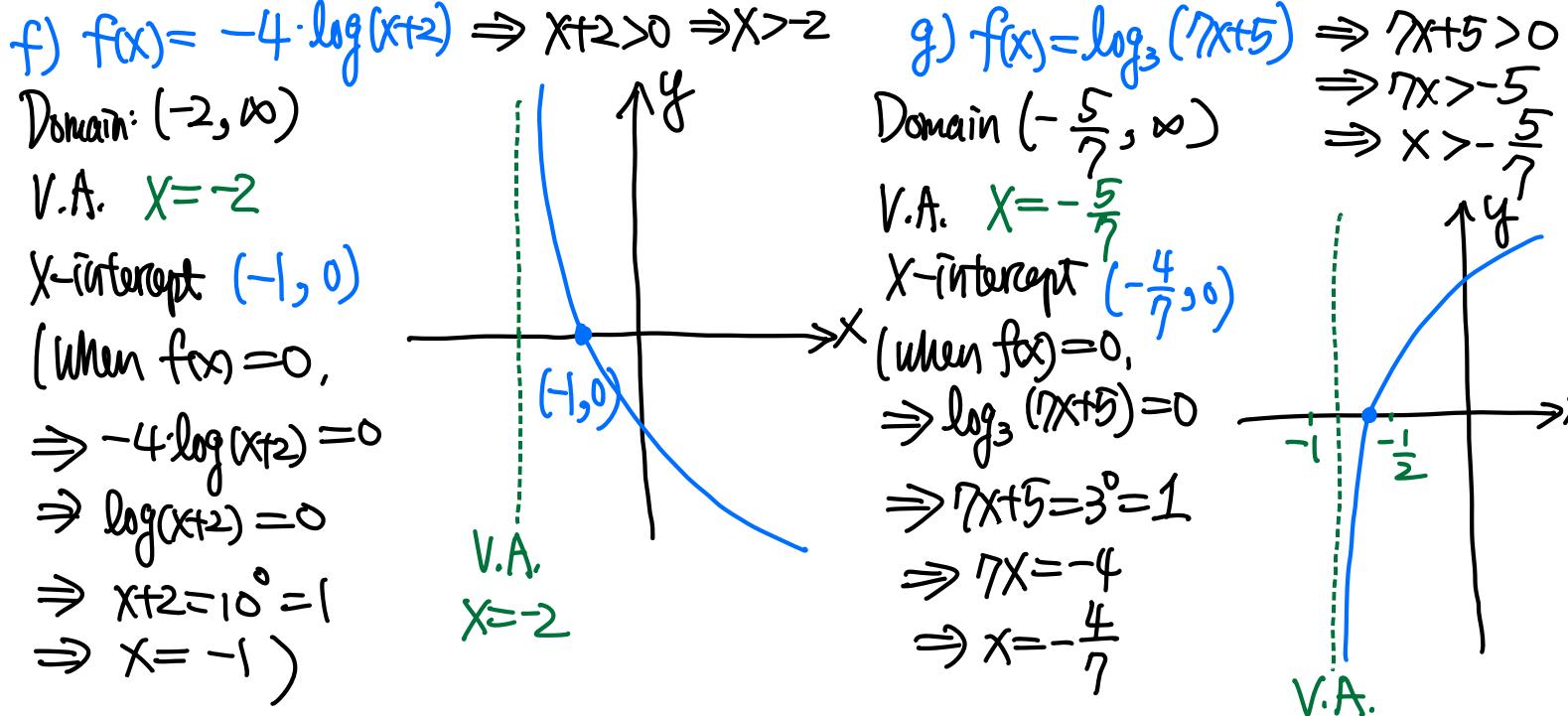
(when $f(x)=0 \Rightarrow 2 \cdot \log(x+4)=0$)

$$\Rightarrow \log(x+4)=0$$

$$\Rightarrow x+4=10^0=1$$

$$\Rightarrow x=-3$$





h) $f(x) = \ln(-6x+14) \Rightarrow -6x+14 > 0$
 $\Rightarrow 6x < 14$
 $\Rightarrow x < \frac{14}{6} = \frac{7}{3}$

Domain: $(-\infty, \frac{7}{3})$

V.A. $x = \frac{7}{3}$

X-intercept $(\frac{13}{6}, 0)$

($f(x) = 0 \Rightarrow \ln(-6x+14) = 0$
 $\Rightarrow -6x+14 = e^0 = 1$

$\Rightarrow -6x = -13$

$\Rightarrow x = \frac{13}{6}$

