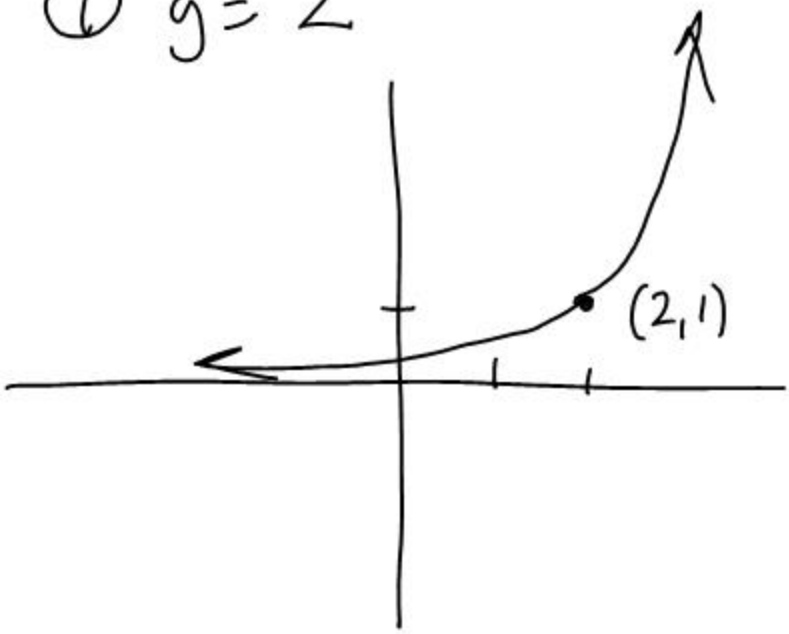
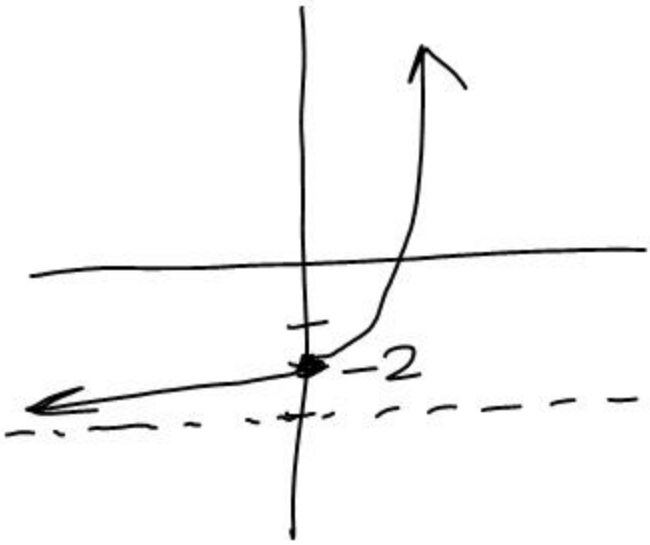
Exponential graphs

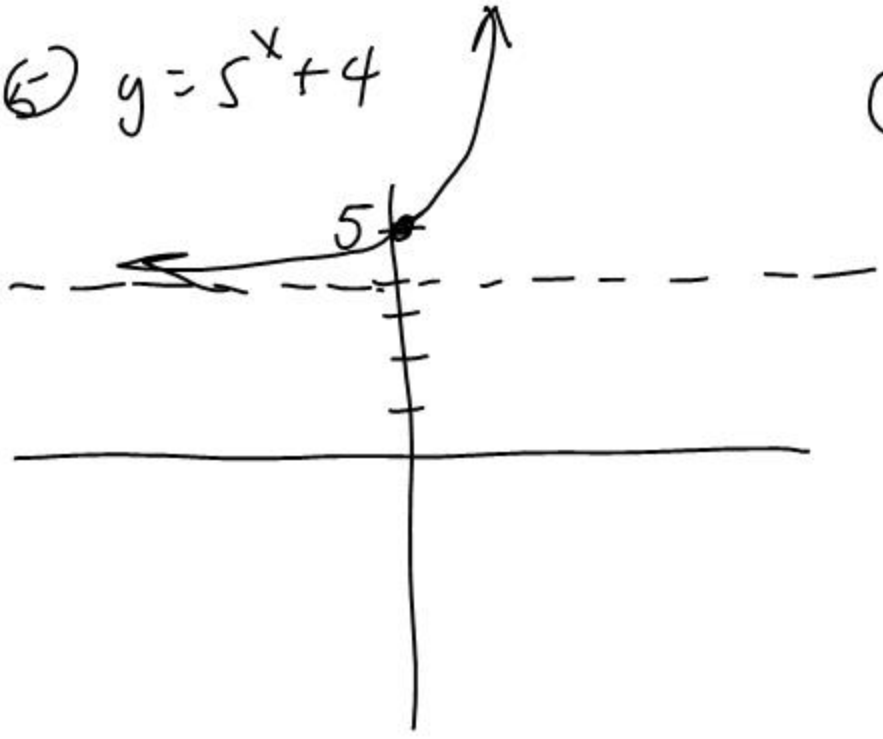
① $y = 2^{x-2}$



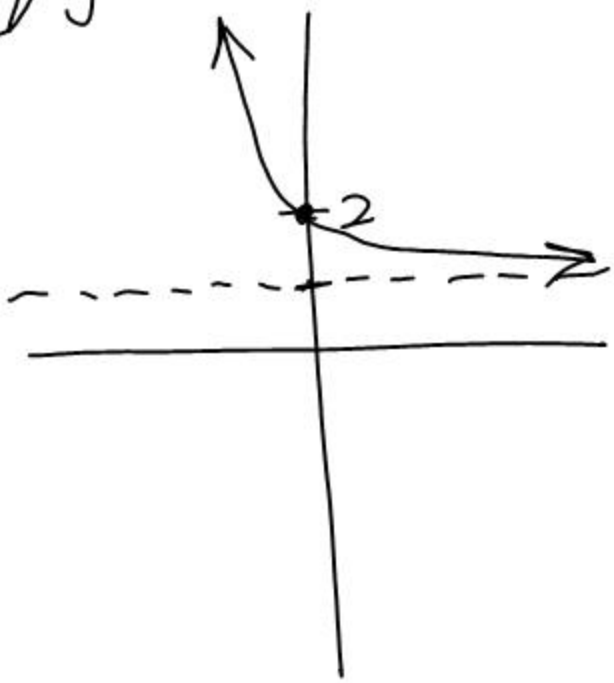
③ $y = 10^{x} - 3$



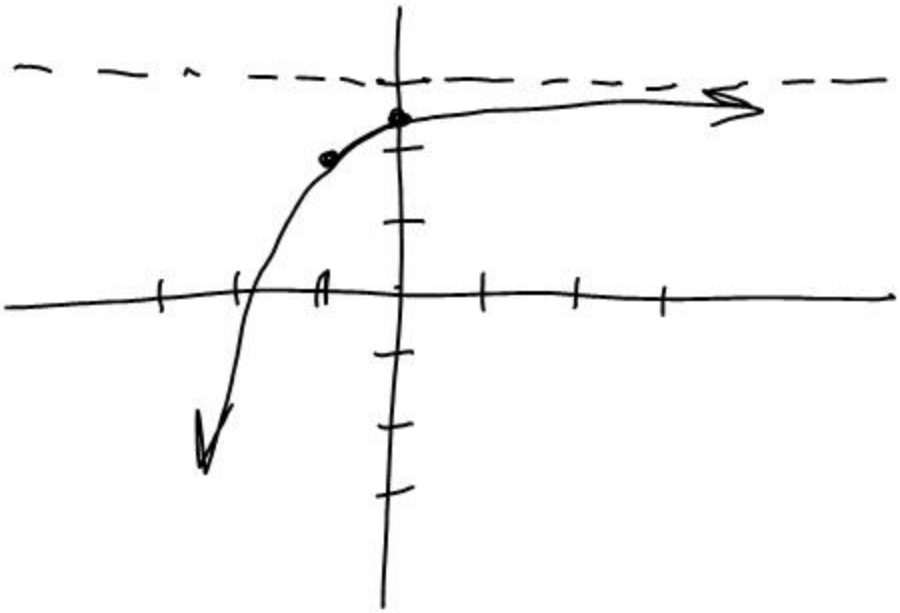
⑥ $y = 5^{x} + 4$



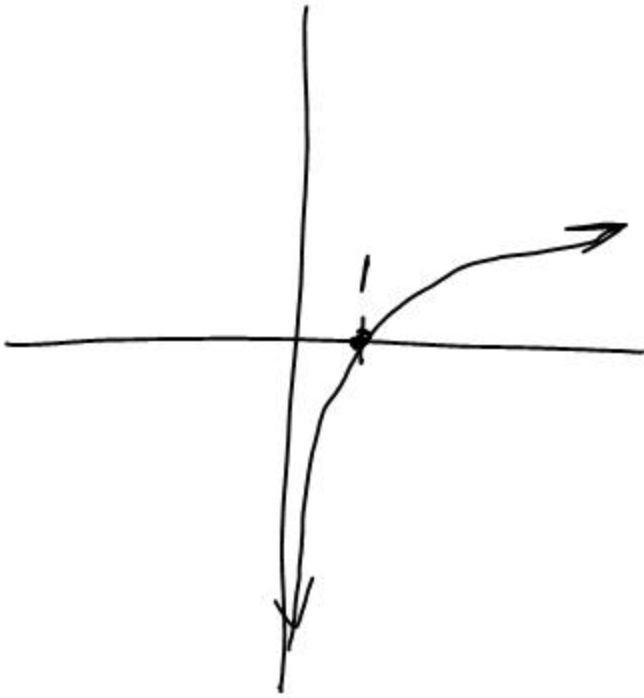
⑦ $y = e^{-x} + 1$



④ $y = 3 - 2^{-1-x}$

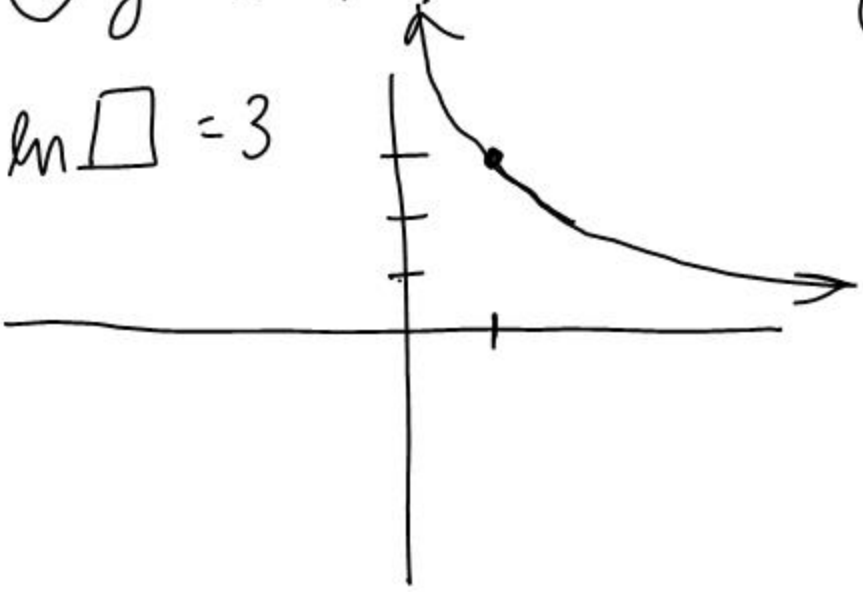


① $y = \log_2 x$

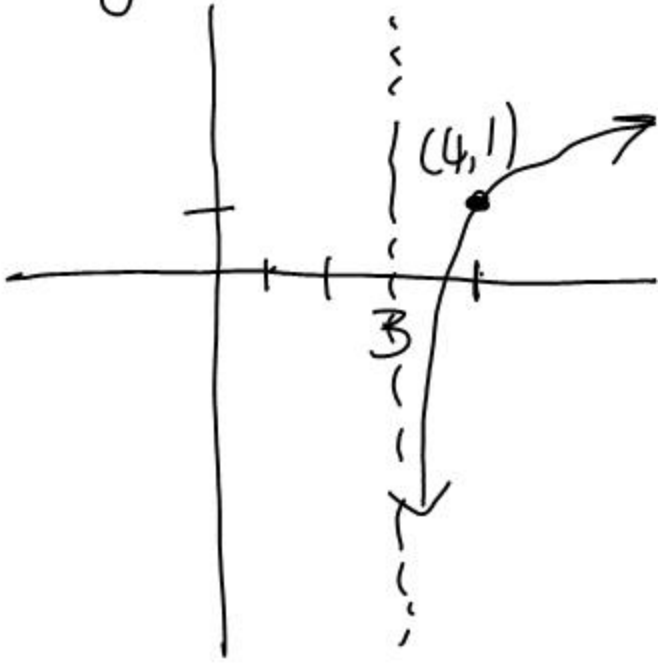


③ $y = 3 - \ln x$

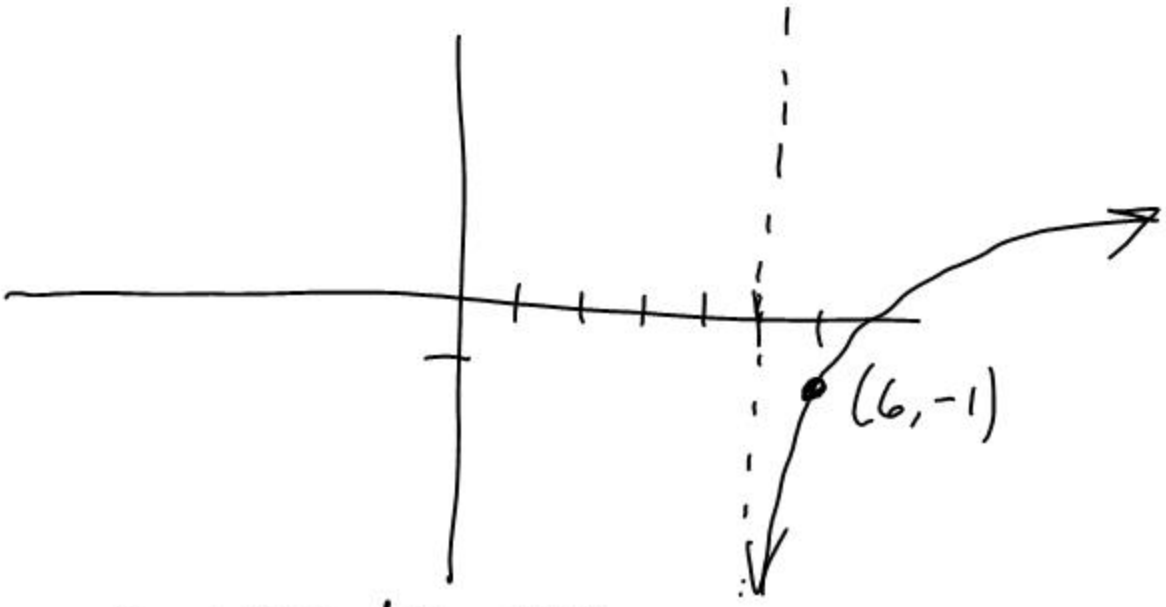
$\ln \square = 3$



⑤ $y = 1 + \ln(x-3)$



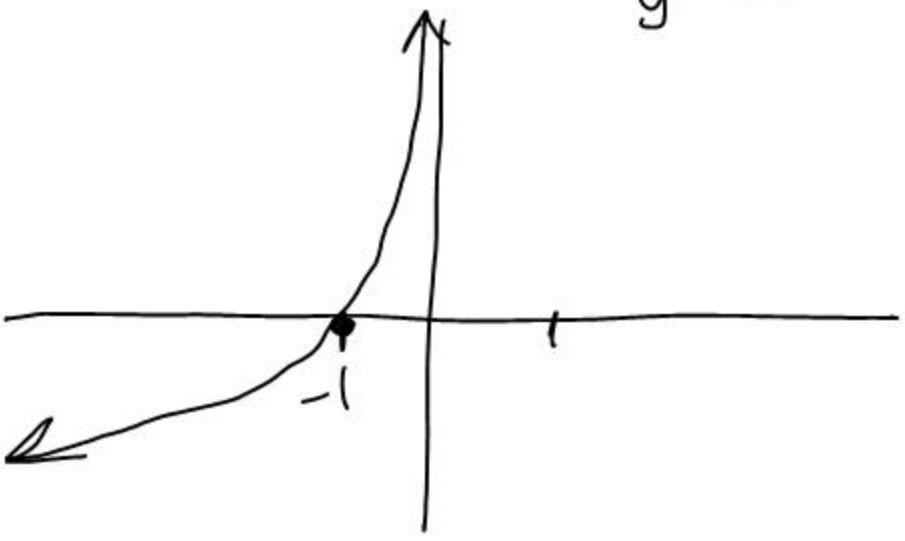
(7) $y = -1 + \ln(x-5)$



flips around x-axis

(9) $y = -\ln(-x)$

↑ flips around y-axis



20(c) $\log_3 9 = 2$

24(c) $\log_9 \sqrt{3} = \log_9 \sqrt{\sqrt{9}} = \log_9 9^{1/4} = \frac{1}{4}$

27(c) $\ln\left(\frac{1}{e}\right) = \ln(e^{-1}) = -1$

27(a) $\log_8 0.25 = \log_8 \frac{1}{4} = -\frac{2}{3}$

$8^{\square} = \frac{1}{4}$

$2^{3\square} = 2^{-2}$ $\quad 3x = -2$

The Log Rules

Exponent Rule: $a^m \cdot a^n = a^{m+n}$

$\underbrace{a \cdot a \cdot a \cdots a}_{m \text{ factors of } a} \; \underbrace{a \cdots a}_{n \text{ factors of } a}$

$m+n$ factors of a

$$2^{\log_2 5 + \log_2 6} = 2^{\log_2 5} \cdot 2^{\log_2 6} = 5 \cdot 6$$

$$a^{m+n} = a^m \cdot a^n = 30$$

$$2^{\log_2 5 + \log_2 6} = 2^{\log_2 30}$$

$$\boxed{\log a + \log b = \log(ab)}$$

$$\underbrace{\log a + \log a + \log a + \cdots + \log a}_{b \text{ terms}}$$

$$\boxed{b \cdot \log a = \log a^b}$$

$$\log a - \log b = \log a + \log b^{-1}$$

$$= \log(a \cdot b^{-1})$$

$$\boxed{\log a - \log b = \log\left(\frac{a}{b}\right)}$$

p. 32

#14 $\log_3 100 - \log_3 18 - \log_3 50$

$= \log_3 100 - (\log_3 18 + \log_3 50)$

$= \log_3 100 - \log_3 (18 \cdot 50)$

$= \log_3 \frac{\overset{2}{\cancel{100}}}{18 \cdot \cancel{50}} = \log_3 \frac{1}{9} = -2$

#22 Expand $\log_5 \frac{x}{2}$

$= \log_5 x - \log_5 2$

#34 Expand: $\log \left(\frac{a^2}{b^4 \sqrt{c}} \right)$

eliminate exponents

$= \log a^2 - \log (b^4 \sqrt{c})$

$= \log a^2 - (\log b^4 + \log \sqrt{c})$

$= 2 \log a - 4 \log b - \frac{1}{2} \log c$

Ex. Condense $\log_2 x - \log_2 (x+1)$

$$= \log_2 \left(\frac{x}{+1} \right)$$

condense

#49. $4 \log x - \frac{1}{3} \log (x^2+1) + 2 \log (x-1)$

$$= \log x^4 - \log (x^2+1)^{1/3} + \log (x-1)^2$$

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

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

$\log_b a = L$

$b^L = a$

Ex. Solve $\log_5 (x+1) - \log_5 (x-1) = 2$

condense the left side

$$\log_5 \left(\frac{x+1}{x-1} \right) = 2$$

$$5^2 = \frac{x+1}{x-1}$$

$$25x - 25 = x + 1$$

$$24x = 26$$

$$x = \frac{26}{24}$$

$$x = \frac{13}{12}$$

solve for x

#54. $\ln(x-1) + \ln(x+2) = 1$

log form $\ln(x^2 + x - 2) = 1$

exp. form $e^1 = x^2 + x - 2$

$$x^2 + x - (e+2) = 0$$

$$x = \frac{-1 \pm \sqrt{1 + 4(e+2)}}{2}$$

$$x = \frac{-1 \pm \sqrt{4e + 9}}{2}$$

$$\boxed{x = \frac{-1 + \sqrt{4e + 9}}{2}}$$

HW p. 329 # 7, 9, 12, 13

expand # 31, 32, 33, 38

condense # 46, 47, 50,

p. 338

log eqs # 45, 47, 48, 50