Section 5.1

3) $(5^{\sqrt{3}})^{\sqrt{3}} = 5^{\sqrt{3}\cdot\sqrt{3}} = 5^3 = 125$

4) $(\sqrt{2}^{\sqrt{2}})^{\sqrt{2}} = \sqrt{2}^{\sqrt{2}\cdot\sqrt{2}} = \sqrt{2}^2 = \sqrt{2}\cdot\sqrt{2} = 2$

5) $(4^{1+\sqrt{2}})(4^{1-\sqrt{2}}) = 4^{(1+\sqrt{2})+(1-\sqrt{2})} = 4^2 = 16$

6) $(3^{2+\sqrt{5}})(3^{2-\sqrt{5}}) = 3^{2+\sqrt{5}+2-\sqrt{5}} = 3^4 = 81$

7) $\dfrac{2^{4+\pi}}{2^{1+\pi}} = 2^{(4+\pi)-(1+\pi)} = 2^{4+\pi-1-\pi} = 2^3 = 8$

8) $\dfrac{10^{\pi+2}}{10^{\pi-2}} = 10^{(\pi+2)-(\pi-2)} = 10^{\pi+2-\pi+2} = 10^4$
$= 10{,}000$

9) $(\sqrt{5}^{\sqrt{2}})^2 = \sqrt{5}^{2\cdot\sqrt{2}} = (5^{\frac{1}{2}})^{2\cdot\sqrt{2}} = 5^{\frac{1}{2}\cdot 2\cdot\sqrt{2}} = 5^{\sqrt{2}}$

10) $(\sqrt{3}^{\pi})^4 = 3^{\frac{1}{2}\cdot\pi\cdot 4} = 3^{2\cdot\pi} = 9^{\pi}$

12) a.) $2^x = 32 \rightarrow 2^x = 2^5 \rightarrow x = 5$

b.) $2^t = 1/4 \rightarrow 2^t = 1/2^2 \rightarrow 2^t = 2^{-2} \rightarrow t = -2$

c.) $2^{3y+1} = \sqrt{2} \rightarrow 2^{3y+1} = 2^{1/2} \rightarrow 3y+1 = 1/2 \rightarrow$
$3y = -1/2 \rightarrow y = -1/6$

d.) $8^{z+1} = 32\sqrt{2} \rightarrow (2^3)^{z+1} = 2^5 \cdot 2^{1/2} \rightarrow$
$2^{3z+3} = 2^{5+1/2} \rightarrow 2^{3z+3} = 2^{11/2} \rightarrow 3z+3 = 11/2 \rightarrow$
$3z = \frac{11}{2} - 3 = \frac{11}{2} - \frac{6}{2} = \frac{5}{2} \rightarrow z = 5/6$

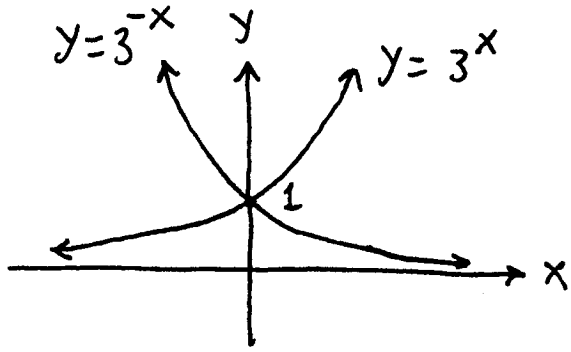
15) $y = \dfrac{1}{2^{x-1}}$; $2^{x-1} > 0$ so Domain: all x-values

16) $y = \frac{1}{2^x - 1}$; $2^x - 1 = 0 \rightarrow 2^x = 1 \rightarrow x = 0$

Domain: all $x \neq 0$

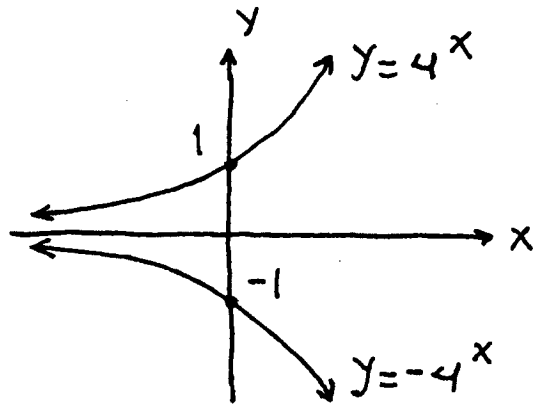
18)

x	-3	-2	-1	0	1	2	3
3^x	$\frac{1}{27}$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27
3^{-x}	27	9	3	1	$\frac{1}{3}$	$\frac{1}{9}$2	$\frac{1}{27}$



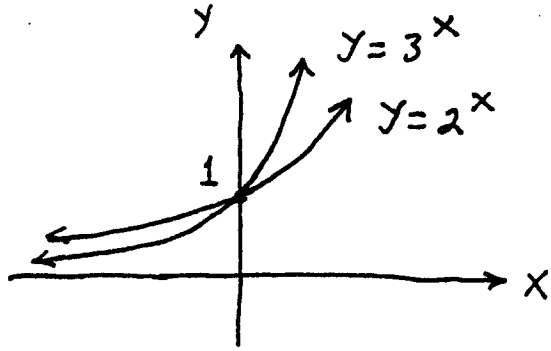
20)

x	-3	-2	-1	0	1	2	3
4^x	$\frac{1}{64}$	$\frac{1}{16}$	$\frac{1}{4}$	1	4	16	64
-4^x	$-\frac{1}{64}$	$-\frac{1}{16}$	$-\frac{1}{4}$	-1	-4	-16	-64



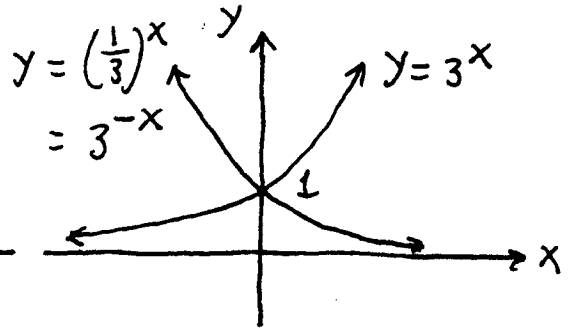
21)

x	-3	-2	-1	0	1	2	3
2^x	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8
3^x	$\frac{1}{27}$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27



22)

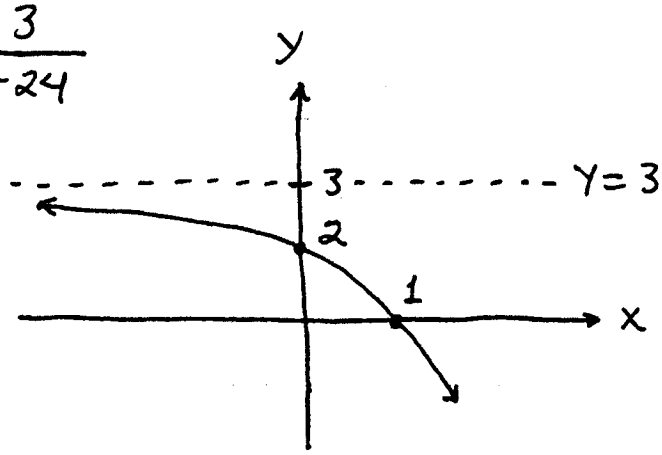
x	-3	-2	-1	0	1	2	3
$(\frac{1}{3})^x$	27	9	3	1	$\frac{1}{3}$	$\frac{1}{9}$	$\frac{1}{27}$
3^x	$\frac{1}{27}$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27



26) $y = -3^x + 3$

x	-3	-2	-1	0	1	2	3
-3^x+3	$2\frac{26}{27}$	$2\frac{8}{9}$	$2\frac{2}{3}$	2	0	-6	-24

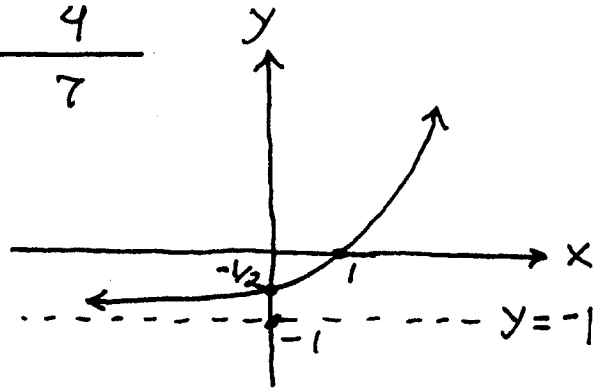
Domain: all x-values;
$x=0: y=2$; $y=0: x=1$;
Range: all $y<3$;
asymptote: $y=3$



30) $y = 2^{x-1} - 1$

x	-3	-2	-1	0	1	2	3	4
$2^{x-1}-1$	$-\frac{15}{16}$	$-\frac{7}{8}$	$-\frac{3}{4}$	$-\frac{1}{2}$	0	1	3	7

Domain: all x-values;
$x=0: y=-\frac{1}{2}$; $y=0: x=1$;
Range: all $y>-1$;
asymptote: $y=-1$



40) $4x^2(2^x) - 9(2^x) = 0 \rightarrow$

$2^x \cdot [4x^2 - 9] = 0 \rightarrow 2^x(2x-3)(2x+3) = 0 \rightarrow$

$(2^x \neq 0!)$ $2x-3=0 \rightarrow x = \frac{3}{2}$ or $2x+3=0 \rightarrow x = -\frac{3}{2}$.

41) $3(3^x) - 5x(3^x) + 2x^2(3^x) = 0 \rightarrow$

$3^x[2x^2 - 5x + 3] = 0 \rightarrow 3^x(2x-3)(x-1) = 0 \rightarrow$

$(3^x \neq 0!)\ 2x-3=0 \rightarrow x = 3/2$ or $x-1=0 \rightarrow x=1$

42) $\dfrac{(x+4)10^x}{x-3} = 2x(10^x) \rightarrow$

$(x+4)10^x = 2x(x-3)(10^x) \rightarrow$

$(x+4)10^x - (2x^2-6x)10^x = 0 \rightarrow$

$10^x \cdot [(x+4) - (2x^2-6x)] = 0 \rightarrow$

$10^x \cdot [-2x^2+7x+4] = 0 \rightarrow$

$10^x \cdot (-2x-1)(x-4) = 0 \rightarrow$

$(10^x \neq 0)\ -2x-1=0 \rightarrow x = -1/2$ or $x-4=0 \rightarrow x=4$

45) $f(x) = 2^x$ then

$$\frac{f(x+h)-f(x)}{h} = \frac{2^{x+h}-2^x}{h} = \frac{2^x \cdot 2^h - 2^x}{h}$$

$$= \frac{2^x(2^h-1)}{h}$$

46) $\phi(t) = 1+a^t$ then

$$\frac{1}{\phi(t)} + \frac{1}{\phi(-t)} = \frac{1}{1+a^t} + \frac{1}{1+a^{-t}} = \frac{1}{1+a^t} + \frac{1}{1+\frac{1}{a^t}}$$

$$= \frac{1}{1+a^t} + \frac{1}{1+\frac{1}{a^t}} \cdot \frac{a^t}{a^t} = \frac{1}{1+a^t} + \frac{a^t}{a^t+1} = \frac{1+a^t}{1+a^t} = 1$$

48) $S = \dfrac{2^x - 2^{-x}}{2}$, $C = \dfrac{2^x + 2^{-x}}{2}$ then

$$[C(x)]^2 - [S(x)]^2 = \left(\frac{2^x + 2^{-x}}{2}\right)^2 - \left(\frac{2^x - 2^{-x}}{2}\right)^2$$

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

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

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

$$= \cancel{\frac{1}{4}2^{2x}} + \frac{2}{4} + \cancel{\frac{1}{4}2^{-2x}} - \cancel{\frac{1}{4}2^{2x}} + \frac{2}{4} - \cancel{\frac{1}{4}2^{-2x}}$$

$$= \frac{1}{2} + \frac{1}{2} = 1 .$$

Section 5.2

1) $e < \frac{1}{2}$ FALSE since $e \approx 2.7$

2) $e < \frac{5}{2} = 2.5$ FALSE since $e \approx 2.7$

3) $\sqrt{e} < 1$ FALSE since $e > 1$ so $\sqrt{e} > \sqrt{1} = 1$

4) $e^2 < 4$ FALSE since $e > 2$ so $e^2 > 2^2 = 4$

5) $e^2 < 9$ TRUE since $e < 3$ so $e^2 < 3^2 = 9$

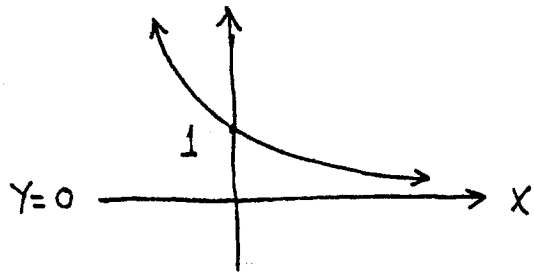
6) $e^3 < 27$ TRUE since $e < 3$ so $e^3 < 3^3 = 27$

7) $e^{-1} < 0$ FALSE since $e^{-1} = \frac{1}{e}$

8) $e^0 = 1$ TRUE

12) $y = e^{-x}$

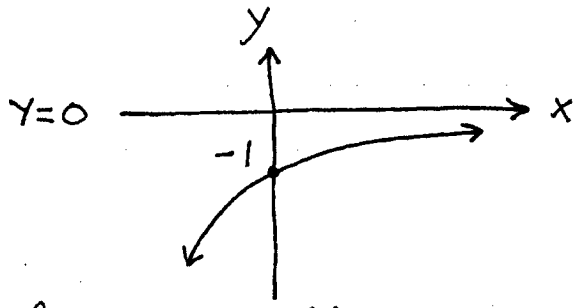
x	-3	-2	-1	0	1	2	3
y	e^3	e^2	e	1	$\frac{1}{e}$	$\frac{1}{e^2}$	$\frac{1}{e^3}$



Domain: all x-values ;
Range: all $y > 0$;
$x = 0$: $y = 1$; $y = 0$: impossible ;
asymptote: $y = 0$

14) $y = -e^{-x}$

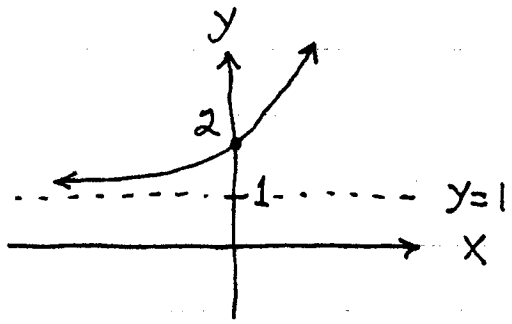
x	-3	-2	-1	0	1	2	3
y	$-e^3$	$-e^2$	$-e$	-1	$-\frac{1}{e}$	$-\frac{1}{e^2}$	$-\frac{1}{e^3}$



Domain: all x-values ; Range: all $y < 0$;
$x = 0$: $y = -1$; $y = 0$: impossible ;
asymptote: $y = 0$

15) $y = e^x + 1$

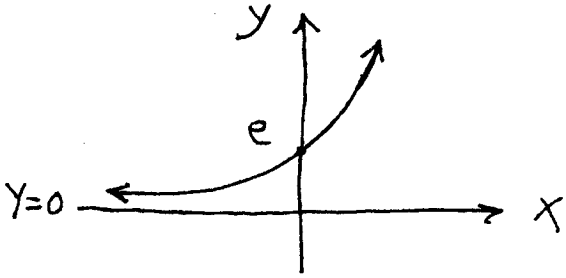
x	-3	-2	-1	0	1	2	3
y	1.05	1.14	1.37	2	3.7	8.4	21.1



Domain: all x-values ; Range: all $y > 1$;
$x = 0$: $y = 2$; $y = 0$: impossible ;
asymptote: $y = 1$

16) $y = e^{x+1}$

x	-3	-2	-1	0	1	2	3
y	$\frac{1}{e^2}$	$\frac{1}{e}$	1	e	e^2	e^3	e^4



Domain: all x-values ; Range: all $y > 0$;
$x = 0$: $y = e$; $y = 0$: impossible ;
asymptote: $y = 0$

$y > 0$;