(1) Functions that involve some combo of basic arithmetic operations, powers or roots are <u>algebraic</u> functions

(2) Exponential and logarithmic functions are <u>transcendental</u> functions.

(3) A function of the form $f(x) = a^x$, where a & x are real, $a > 0$, and $a \neq 1$, is an <u>exponential function</u>.

(4) The domain of $f(x) = a^x$ for $a > 0$ is $\mathbb{R}$.

(5) $f(x) = a^x$ is <u>increasing</u> if $a > 1$ & <u>decreasing</u> if $a < 1$.

(6) $f(x) = a^x$ has <u>x-axis</u> as <u>horizontal asymptote</u>.

(7) The <u>range</u> of $f(x) = a^x$ is $(0, \infty)$

(8) The exponential family of functions consists of all functions of the form $f(x) = b \cdot a^{x-h} + k$.

121 §4.1

Eval. w/o calculator

9 $3^3 = 27$ (15) $\left(\frac{1}{2}\right)^{-4} = \left(\frac{2}{1}\right)^4 = 2^4 = 16$

10 $-9^{-\frac{3}{2}} = -\left(9^{\frac{1}{2}}\right)^{-3} = -3^{-3} = -\frac{1}{3^3} = -\frac{1}{27}$

#s 21-32 $f(x) = 3^x$, $g(x) = 2^{1-x}$, $h(x) = \left(\frac{1}{4}\right)^x$ or 4^{-x}

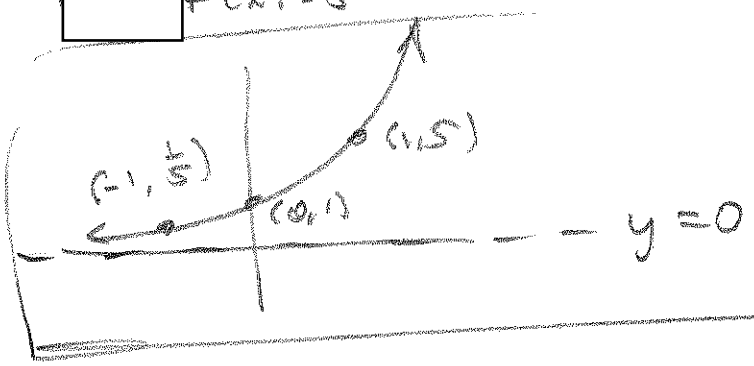
11 $f(-2) = 3^{-2} = \frac{1}{9}$

12 $g(2) = 2^{1-2} = 2^{-1} = \frac{1}{2}$

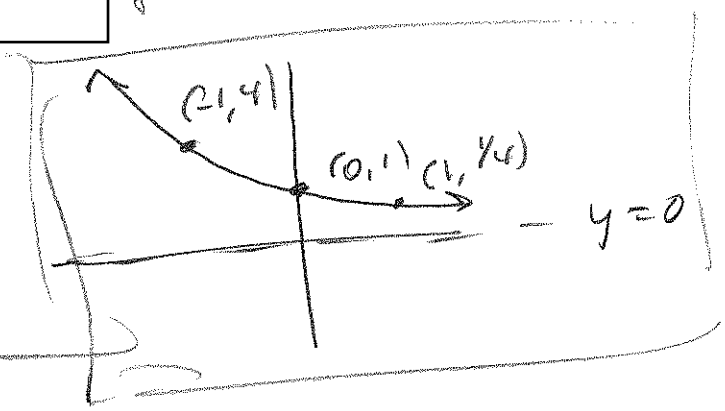
13 $h(-1) = 4^{-(-1)} = 4$

Sketch

14 $f(x) = 5^x$



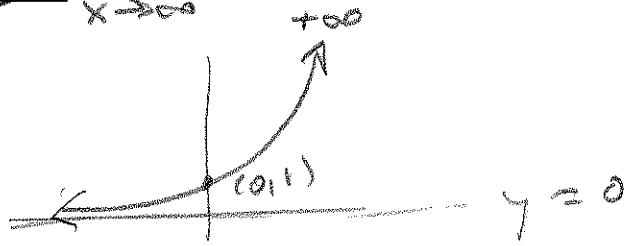
15 $f(x) = \left(\frac{1}{4}\right)^x$



121 §4.1

Use graph / table to find each limit.

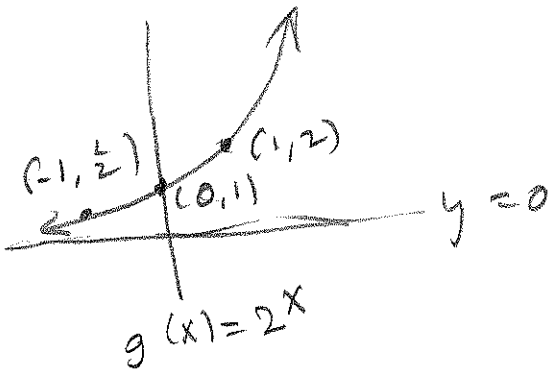
16 $\lim_{x \to \infty} 3^x = \infty$ $3^{1000} =$ Huge!



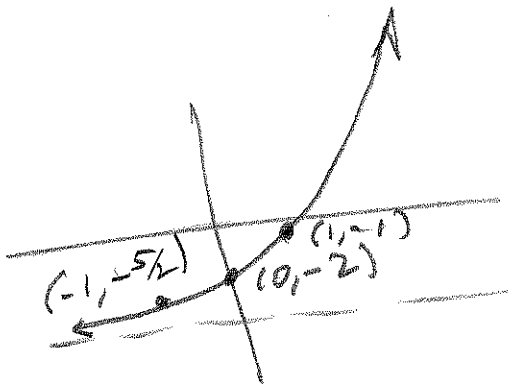
17 $\lim_{x \to \infty} \left(\frac{1}{3}\right)^x = 0$

Sketch

18 $f(x) = 2^x - 3$



$g(x) = 2^x$

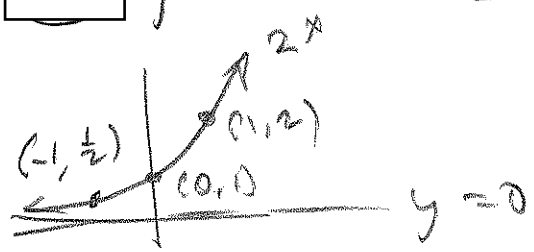


$\frac{1}{2} - 3 = \frac{1}{2} - \frac{6}{2} = -\frac{5}{2}$

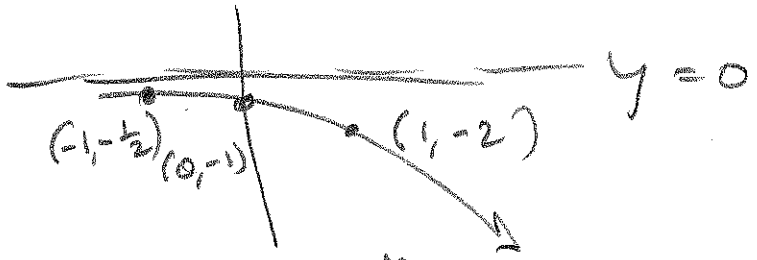
$g(x) - 3 = 2^x - 3 = f(x)$

121 §4.1

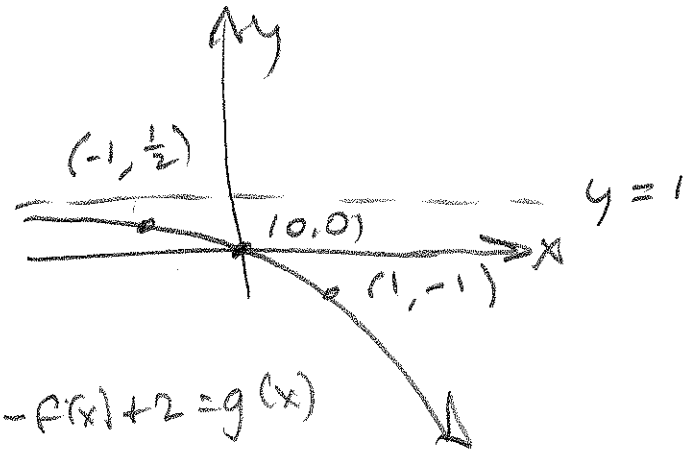
19 $y = 1 - 2^x = -2^x + 1 = g(x)$



$f(x) = 2^x$ BASIC



$-f(x) = -2^x$



$-f(x) + 2 = g(x)$

$= -2^x + 1$

Write the eq'n from transformations

20 $y = 2^x$ 5 right, 2 down

$f(x) = 2^{x-5} - 2$

21 $(\frac{1}{4})^x$ 1 right, reflected in x-axis, 2 down

$f(x) = -(\frac{1}{4})^{x-1} - 2$

12.1 S4.1 ...

#s 63 - 80 Solve,

22

$10^x = 0.1 = \frac{1}{10} = 10^{-1}$

$x = -1$

23

$8^x = 2$

$(2^3)^x = 2$

$2^{3x} = 2^1$

$3x = 1$

$x = \frac{1}{3}$

$8^x = 2$

$8^x = 8^{\frac{1}{3}}$

$x = \frac{1}{3}$

24

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

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

$(2^{-1})^x = 2^3$

$2^{-x} = 2^3$

$-x = 3$

$x = -3$

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

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

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

$x = -3$

121 §4.1

25

A deposit of P = 5000 earns 8% apr.
Find amt in account @ end of t=6 yrs.
and the amt of Interest earned if interest is compounded...

(a) ... annually ; m = 1

$A = P(1+\frac{r}{m})^{mt} = 5000(1+.08)^6 \approx \$7934.37$ A

Interest = A − P = I ≈ 7934.37 − 5000 = $\$2934.37$ I

(b) ... quarterly : m = 4

$A = 5000(1+\frac{.08}{4})^{4(6)} \approx \$8042.19$ A

$I = A - P \approx 8042.19 - 5000 = \$3042.19$ I

(c) ... monthly m = 12

$A = 5000(1+\frac{.08}{12})^{12(6)} \approx \$8067.51$ A

$I = A - P \approx 8067.51 - 5,000 = \$3067.51$ I

(d) ... daily m = 365

$A = 5000(1+\frac{.08}{365})^{365(6)} \approx \$8079.95$ A

$I = A - P \approx 8079.95 - 5000 = \$3079.95$ I

(e) ... continuously

$A = Pe^{rt} = 5000e^{(.08)(6)} \approx \$8080.37$ A

$I = A - P \approx 8080.37 - 5000 = \$3080.37$ I

121) §4.1

26

APR = 8% compounded cont'ly, P = $5000

Find future value A.

(a) 6 yrs: $A = 5000e^{(.08)(6)} \approx$ **$8080.37**

(b) 8 yrs + 3 mos = 8 yrs + $(3\text{ mos})\left(\frac{1\text{ yr}}{12\text{ mos}}\right)$

$= 8.25$ yr $\Rightarrow$

$A = 5000e^{(.08)(8.25)} \approx$ **$9673.96**

(c) 5 yrs, 4 mos, 22 days

$(4\text{ mos})\left(\frac{1\text{ yr}}{12\text{ mos}}\right) = \frac{1}{3}\text{ yr} = .\overline{3}$

$(22\text{ days})\left(\frac{1\text{ yr}}{365\text{ days}}\right) = \frac{22}{365} \approx .060273972\overline{6}$

$.\overline{3} + .060273972\overline{6} \approx .393607305\overline{9}$

$\Rightarrow 5.393607305\overline{9} = t$

$A(6) = 5000e^{.08(5.393607305\overline{9})} \approx$ **$7697.74**

(d) 20 yrs, 321 days

$(321\text{ days})\left(\frac{1\text{ yr}}{365\text{ days}}\right) \approx .879452054\overline{8}$

$20.879452054\overline{8}$ yrs

$A = 5000e^{(.08)(20.879452054\overline{8})} \approx$ **$26,570.30**