Practice for the Final Solutions
MAC 1105
Sullivan — Version 1 (2007)
Kincade

1. $(-1,-2)$, $(6,-3)$

$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
$= \sqrt{(-1-6)^2 + (-2+3)^2}$
$= \sqrt{49+1} = \sqrt{50} = 5\sqrt{2}$

$2\,|\,50$
$5\,|\,25$
5

2. $(5,5)$, $(5,1)$

same x-coordinate, so $\boxed{x=5}$ equation of the line

$d = \sqrt{(5-5)^2 + (5-1)^2}$
$= \sqrt{0+4^2} = \sqrt{16} = \boxed{4}$

3. $(-5,6)$, $(-4,-2)$

$d = \sqrt{(-5+4)^2 + (6--2)^2}$
$= \sqrt{(-1)^2 + (8)^2}$
$= \sqrt{1+64} = \sqrt{65}$

4. midpoint formula $= \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$(9x, 2)$, $(10x, 9)$

$\left(\frac{9x+10x}{2}, \frac{2+9}{2}\right) = \boxed{\left(\frac{19x}{2}, \frac{11}{2}\right)}$

5. $(-1,-7)$, $(3,-4)$

$\left(\frac{-1+3}{2}, \frac{-7-4}{2}\right) = \left(\frac{2}{2}, \frac{-11}{2}\right) = \boxed{\left(1, \frac{-11}{2}\right)}$

6. $(0.2, 0.1)$, $(-1.3, 2.3)$

$\left(\frac{0.2-1.3}{2}, \frac{0.1+2.3}{2}\right) = \boxed{(-0.55, 1.2)}$

7. $\boxed{y^2-x-1=0}$ Find the intercepts

$\boxed{\text{x-int}}$ $y=0$: $-x-1=0$, $x=-1$

$\boxed{\text{y-int}}$ $x=0$: $y^2-1=0$, $y=\pm 1$

$\boxed{(-1,0)\ (0,-1)\ (0,1)}$

8) $\boxed{x\text{-int}}$ $(-\pi/2, 0)$
$(\pi/2, 0)$

$\boxed{y\text{-int}}$ $(0,3)$

9) $\boxed{x\text{-int}}$ $(-4,0)$
$(1,0)$
$(5,0)$

$\boxed{y\text{-int}}$ $(0,4)$

10) $\boxed{x\text{-int}}$
$y=0$
$x^2 = y$
$x^2 = 0$
$x = 0$
$\boxed{(0,0)}$

$\boxed{y\text{int}}$
$x=0$
$x^2 = y$
$0 = y$
$(0,0)$

11) $9x^2 + 16y^2 = 144$

$\boxed{x\text{-int}}$
$y=0$
$9x^2 = 144$
$x^2 = \frac{144}{9}$
$x = \pm\frac{12}{3} = \pm 4$

$\boxed{(4,0)\ (-4,0)}$

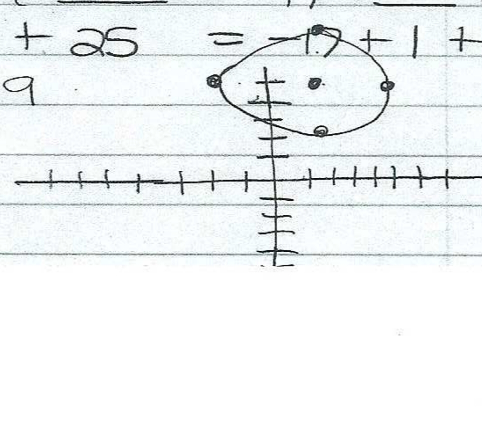
$\boxed{y\text{-int}}$
$x=0$
$16y^2 = 144$
$y^2 = \frac{144}{16}$
$y = \pm\frac{12}{4} = \pm 3$

$\boxed{(0,3)\ (0,-3)}$

12) symmetry WRT y-axis (fold on y-axis)
x-axis (fold on x-axis)
origin (fold twice) or
check for opposites
($y = x$ symmetry)

13) none
14) y-axis
15) none

16) $x^2 + y^2 - 2x - 10y + 17 = 0$
$x^2 - 2x + \_\_\_ + y^2 - 10y + \_\_\_ = -17 + \_\_\_ + \_\_\_$
$x^2 - 2x + 1 + y^2 - 10y + 25 = -17 + 1 + 25$
$(x-1)^2 + (y-5)^2 = 9$



center $= (1,5)$
radius $= \sqrt{9} = 3$

17 center = midpoint of (4, 5) & (8, 5) = (6, 5)

radius = distance between (4, 5) & (6, 5) = 2

so equation is $(x-6)^2 + (y-5)^2 = 2^2$

$(x-6)^2 + (y-5)^2 = 4$

18 $r = 7$

$(h, k) = (-1, -4)$

$(x+1)^2 + (y+4)^2 = 7^2$

$\boxed{(x+1)^2 + (y+4)^2 = 49}$

standard form

$x^2 + 2x + 1 + y^2 + 8y + 16 = 49$

$x^2 + y^2 + 2x + 8y = 49 - 16 - 1$

$\boxed{x^2 + y^2 + 2x + 8y = 32}$ general form

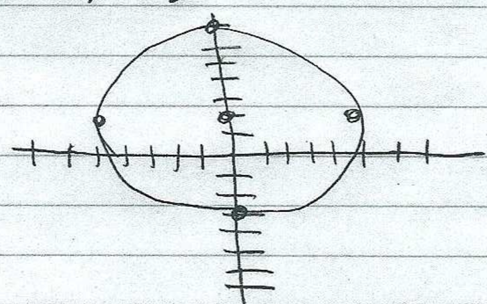
19 $r = \sqrt{13}$

$c = (h, k) = (-10, -8)$

$\boxed{(x+10)^2 + (y+8)^2 = 13}$

20 $r = 5$

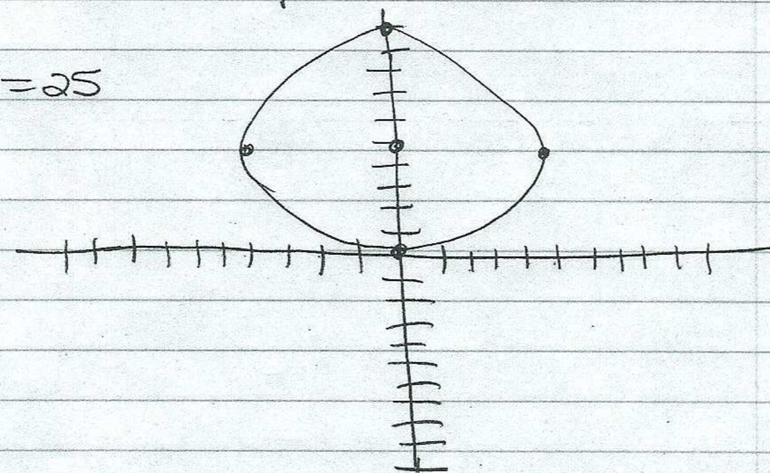
$(h, k) = (0, 2)$



21 $x^2 + (y-5)^2 = 25$

$c = (0, 5)$

$r = 5$



22 $4x^2+4y^2-12x+16y-5=0$

$4x^2-12x+4y^2+16y=5$

$x^2-3x+y^2+4y=\frac{5}{4}$

$x^2-3x+\underset{\left(\frac{-3}{2}\right)^2}{\underline{\quad}}+y^2+4y+\underset{\left(\frac{4}{2}\right)^2}{\underline{\quad}}=5/4+\underline{\quad}+\underline{\quad}$

$x^2-3x+9/4+y^2+4y+4=5/4+9/4+4$ $\leftarrow \frac{16}{4}$

$(x-3/2)^2+(y+2)^2=30/4=15/2$

$c=(3/2,-2)$ $r=\sqrt{30}/2$ or $\sqrt{\frac{15}{2}}$

23 center $=(-4,-3)$
containing $(-3,3)$

radius = distance between the 2 points $=\sqrt{(-4+3)^2+(-3-3)^2}$

$=\sqrt{(-1)^2+(-6)^2}$

$=\sqrt{1+36}=\sqrt{37}$

$(x+4)^2+(y+3)^2=(\sqrt{37})^2$

$x^2+8x+16+y^2+6y+9=37$

$x^2+y^2+8x+6y+16+9-37=0$

$\boxed{x^2+y^2+8x+6y-12=0}$

24 $x^2+y^2+8x+12y=-3$

$x^2+8x+\underset{\left(\frac{8}{2}\right)^2}{\underline{16}}+y^2+12y+\underset{\left(\frac{12}{2}\right)^2}{\underline{36}}=-3+\underline{16}+\underline{36}$

$(x+4)^2+(y+6)^2=49$

$\boxed{\begin{array}{l} c=(h,k)=(-4,-6) \\ r=\sqrt{49}=7 \end{array}}$

(25) vertical line through (7, 2) $\left(\begin{matrix}\text{vertical} \\ x=c\end{matrix}\right)$ $\boxed{x=7}$ (5)

(26) through $(-\frac{4}{9}, 7)$ with undefined slope (vertical) $\boxed{x=\frac{-4}{9}}$

(27) horizontal containing (−1, 2) $\left(\begin{matrix}\text{horizontal} \\ y=c\end{matrix}\right)$ $\boxed{y=2}$

(28) slope = 4 (−4, −10)

$m=\frac{y-y_1}{x-x_1}$

$4=\frac{y+10}{x+4}$

$4(x+4)=y+10$

$4x+16=y+10$

$\boxed{y=4x+6}$

(29) $16x+9y=8$

solve for y to find the slope

$9y=-16x+8$

$\boxed{y=\frac{-16}{9}x+\frac{8}{9}}$ $\boxed{m=\frac{-16}{9}}$

$y=mx+b$

m

(30) $5x+7y=10x+9$

$7y=5x+9$

$\boxed{y=\frac{5}{7}x+\frac{9}{7}}$

$\boxed{m=\frac{5}{7}}$

(31) $9x-10y=90$

$-10y=9x+90$

$y=\frac{-9}{-10}x+\frac{90}{-10}$

$y=\frac{9}{10}x-9$

$y=mx+b$

$\boxed{\begin{matrix}m=\text{slope}=9/10 \\ b=\text{y-int}=(0,9)\end{matrix}}$

(32) slope $= \frac{-6}{7}$ $\qquad \frac{-6}{7} = \frac{y-5}{x-4}$ (6)

$(4,5)$ $\qquad -6(x-4) = 7(y-5)$

Find general form of line

$$-6x + 24 = 7y - 35$$
$$24 + 35 = 6x + 7y$$
$$\boxed{6x + 7y = 59}$$

(33) parallel to $x + 2y = 4$ through $(0,0)$

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

parallel $\Rightarrow$ same slope

$$y = \frac{-1}{2}x + 2$$

with $(0,0)$

$$\frac{-1}{2} = \frac{(y-0)}{(x-0)}$$
$$-x = 2y \Rightarrow y = \frac{-1}{2}x$$

(34) parallel to $y = -4x - 1$ $(2,6)$

$$-4 = \frac{y-6}{x-2}$$

(C)

$$-4(x-2) = y - 6$$
$$-4x + 8 = y - 6$$
$$\boxed{y = -4x + 14}$$

(35) $\perp$ to $y = 2x - 1$ through $(-2,2)$

$m = \frac{-1}{2}$ $\quad (-2,2)$

$\perp \Rightarrow$ opposite reciprocal slopes

$$m = \frac{y - y_1}{x - x_1}$$
$$\frac{-1}{2} = \frac{y-2}{x+2}$$
$$-1(x+2) = 2(y-2)$$
$$-x - 2 = 2y - 4$$
$$-x + 2 = 2y$$
$$y = \frac{-1}{2}x + 1$$

(36) $A = kt^2$ $\qquad A = 180$, $t = 6$

$$180 = k(6)^2$$
$$\frac{180}{36} = 5 = k$$

so $\boxed{A = 5t^2}$ (D)

(37) $V = k\,r^2 h$ $\boxed{V = \frac{1}{3}\pi r^2 h}$ (D)

$k = \frac{1}{3}\pi$

(38) 18 ft in 3 sec

$d = kt^2$

$\boxed{d = 2t^2}$

$18 = k(3)^2$

$18 = k(9)$

$2 = k$

to fall 100 ft,

$d = 2t^2$

$100 = 2t^2$

$50 = t^2$

$\boxed{\sqrt{50} = t}$ sec

$\approx \boxed{7.07\,s = t}$

(39) $A = \frac{k}{x^2}$ $A = 4$, $x = 2$

$4 = \frac{k}{(2)^2}$

$16 = k$

$\boxed{A = \frac{16}{x^2}}$

(40) $H = \frac{k}{T}$ $H = 3$, $T = 0.5 = \frac{1}{2}$

$3 = \frac{k}{\frac{1}{2}}$ $k = \frac{3}{2}$

$H = \frac{3}{2T}$

$H = \frac{3}{2(2.5)} = \boxed{0.6 \text{ hrs}}$

$= \frac{3}{5}$

(41) $z = k\sqrt[3]{x}\,y^3$ $z = 2$, $x = 125$, $y = 2$

$\boxed{z = \frac{1}{20}\sqrt[3]{x}\,y^3}$

$2 = k\sqrt[3]{125}\,(2)^3$

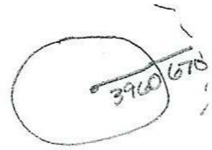
$2 = k(5)(8)$

$\frac{2}{40} = k = \frac{1}{20}$

(A)

42

$$T = \frac{kr}{v}$$



$r = 3960$ mi

670 miles above the earth

$r = 3960 + 670 = 4730$

$$T = \frac{kr}{v}$$

$T = 19$ hrs

$v = 21{,}000$ mph

$r = 4730$ miles

$$19 = \frac{k(4730)}{21{,}000}$$

$$\boxed{k = 84.35}$$

$$T = \frac{(84.35)r}{v}$$

so $r = 3960 + 1600$

$= 5560$ miles

$v = 24{,}000$ mph

$$T = \frac{(84.35)(5560)}{24{,}000}$$

$T \simeq 19.54$ hrs

B

43 vertex $= (-1, 0)$ up $(+)$

through $(0, 1)$

$(-1, 0) = (h, k)$

$(0, 1) = (x, y)$

$$y = a(x-h)^2 + k$$

$1 = a(0+1)^2 + 0$

$1 = a(1) + 0$

$1 = a$

$y = 1(x+1)^2 + 0$

$\boxed{y = (x+1)^2}$

$\boxed{y = (x^2 + 2x + 1)}$

C

44 $f(x) = x^2 + 4x + 3$ not readable

$$h = \frac{-b}{2a} = \frac{-4}{2(1)} = -2$$

$k = (-2)^2 + 4(-2) + 3$

$= 4 - 8 + 3$

$= -1$

$\boxed{(-2, -1) = \text{vertex}}$

axis of symmetry is the vertical line (for vertical parabolas) that passes through the vertex.

$\boxed{\begin{array}{c}\text{axis of symmetry} \\ x = -2\end{array}}$ $\Leftarrow$

45 $(-3,-1)$
$(1,-2)$

point-slope form
$y - y_1 = m(x - x_1)$

$m = \frac{-1+2}{-3-1} = \frac{1}{-4} = -\frac{1}{4}$ $\boxed{y + 1 = -\tfrac{1}{4}(x+3)}$

use the point $(-3,-1)$

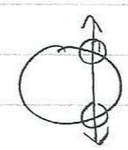
46 $\boxed{F = \frac{kmv^2}{r}}$

47 $6x + 2y = 8$
$2y = -6x + 8$
$y = -3x + 4$

$24x + 8y = 33$
$8y = -24x + 33$
$y = -3x + \frac{33}{8}$

same slope = parallel

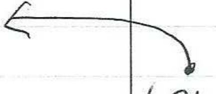
48 function (yes) — no repeating x-values
$D = \{-1, 0, 5, 6\}$
$R = \{-4, -1, 5, 6\}$

49 $y^2 = 3 - x^2$ shape  $\boxed{\text{not a function}}$

50 $f(x) = 3x^3 + 7x^2 - x + c$
$f(-2) = 1$
find c

$f(-2) = 3(-2)^3 + 7(-2)^2 - (-2) + c = 1$
$3(-8) + 28 + 2 + c = 1$
$-24 + 28 + 2 + c = 1$
$6 + c = 1$
$\boxed{c = -5}$

51 $f(x) = \sqrt{21 - x}$

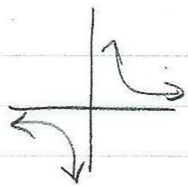


$\boxed{D: x \leq 21 \text{ or } (-\infty, 21]}$

$(21, 0)$
up & left

52 not a function (repeating x value)
since dave $\to$ peas, squash.

53 $y = \frac{1}{x}$ yes A



54 $y = \pm\sqrt{1-3x}$ no B

55 $f(x) = \sqrt{x^2+6x}$
$f(5) = \sqrt{5^2+6(5)} = \sqrt{25+30} = \sqrt{55}$

56 $f(x) = \frac{x}{x^2+5}$ $f(-x) = \frac{-x}{(-x)^2+5} = \boxed{\frac{-x}{x^2+5}}$

57 $f(x) = \frac{x-4A}{8x+1}$ $f(8) = \frac{8-4A}{8(8)+1} = -12$

$f(8) = -12$

$= \frac{8-4A}{64+1} = -12$

$= \frac{8-4A}{65} = -12$

$= 8-4A = -780$

$-4A = -788$

$\boxed{A = +197}$

58 $f(x) = 0$ For what x value is the y value $= 0$?

$X = -15$
$X = 17.5$
$X = 25$

* each mark on the graph is scaled to $\underline{\underline{5}}$ (not 1)

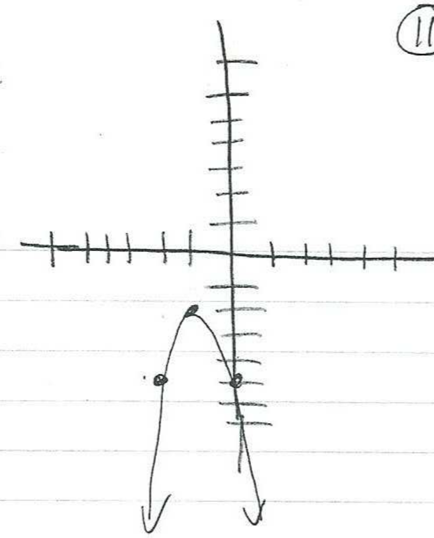
(59) $f(x) = -3(x+1)^2 - 2$

x	y
-3	-14
-2	-5
-1	-2
0	-5
1	-14

vertex $= (-1, -2)$

down

stretched



(60) Inverse $\Rightarrow$ x & y values switch places

not a function

$\{(\underline{\underline{4}}, -3), (5, -1), (2, 0), (\underline{\underline{4}}, 2), (7, 5)\}$

(61) $g(x) = \dfrac{2x}{x^2 - 49}$

$(x+7)(x-7)$

$\boxed{D: \mathbb{R} \text{ except } \pm 7}$

or

$\boxed{(-\infty, -7) \cup (-7, 7) \cup (7, \infty)}$

(62) $\dfrac{x}{\sqrt{x-9}}$

$x - 9 > 0$

$\boxed{x > 9}$ or $\boxed{(9, \infty)}$

(63) $f(x) = 9x - 4$

$g(x) = 5x - 2$

$f - g = (9x-4) - (5x-2)$

$= 9x - 4 - 5x + 2$

$= \boxed{4x - 2}$

$D: \mathbb{R}$

(64) $f(x) = 5x + 1$

$g(x) = 4x - 3$

$\dfrac{f}{g}(x) = \boxed{\dfrac{5x+1}{4x-3}}$

$4x - 3 \neq 0$

$4x \neq 3$

$x \neq 3/4$

(65) function: yes (passes VLT)

no symmetry

D: $x \geq -2$

R: $y \leq 0$

intercepts

$(-2, 0)$ $(0, -2)$ $(2, 0)$

66. $f(40) = \underline{\underline{-80}}$ which is negative

67. origin symmetry $\Rightarrow$ odd

68. y-axis symmetry $\Rightarrow$ even

69. $f(x) = -9x^2+3$
$f(-x) = -9(-x)^2+3$
$= -9x^2+3$

since $f(-x) = f(x)$
even

70. $f(x) = \sqrt[3]{x}$
$f(-x) = \sqrt[3]{-x} = -\sqrt[3]{x}$

since $f(-x) = -f(x)$
odd

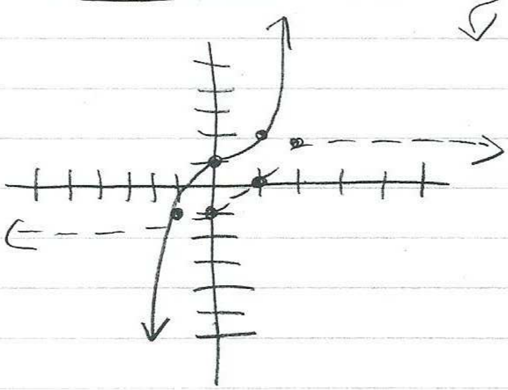
71. $(-3, -3/2)$
$\downarrow \quad \downarrow$

decreasing

$(-3, \underline{\underline{1}})$ $\quad (-3/2, \underline{\underline{-1}})$

72. $\boxed{f(x) = x^3+1}$

x	y
-2	-7
-1	0
0	1
1	2
2	9



x	y
-7	-2
0	-1
1	0
2	1
9	2

Inverse
$y = x^3+1$
$x = y^3+1$
$y^3 = x-1$
$y = \sqrt[3]{x-1}$

f
D: $\mathbb{R}$ except -5
R: $\mathbb{R}$ except $+3$

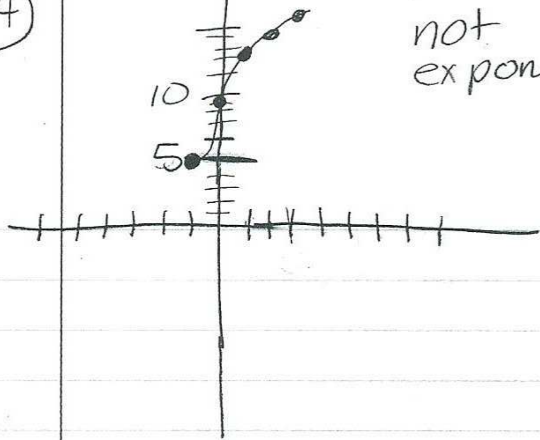
73. $f(x) = \dfrac{3x-2}{x+5}$

$y = \dfrac{3x-2}{x+5}$

$x = \dfrac{3y-2}{y+5}$

$x(y+5) = 3y-2$
$xy+5x = 3y-2$
$xy-3y = -5x-2$
$3y-xy = 5x+2$
$y(3-x) = 5x+2$
$\boxed{y = \dfrac{5x+2}{3-x} = f^{-1}(x)}$

74

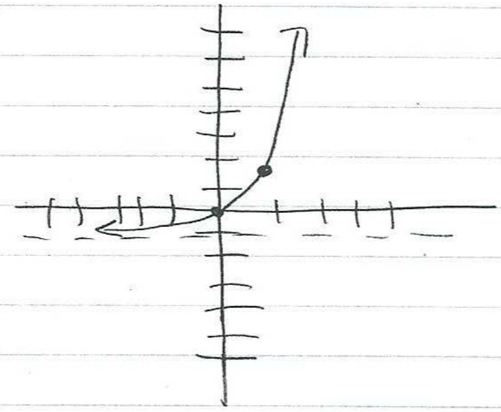


not exponential

75 $\boxed{f(x) = e^x - 1}$

start $(0,1)$
shift $(0,-1)$
$(0,0)$
HA $y = -1$

x	y
-1	$\frac{1}{e} - 1$
0	0
1	$e - 1$
	$2.71 - 1$



$\boxed{\begin{array}{l} D: \mathbb{R} \\ R: y > -1 \end{array}}$

76

$$4^{5-3x} = \frac{1}{256}$$
$$4^{5-3x} = 4^{-4}$$
$$5 - 3x = -4$$
$$-3x = -9$$
$$x = 3$$

77

$$9^{2x} \cdot 27^{(3-x)} = \frac{1}{9}$$
$$3^{2 \cdot 2x} \, 3^{3(3-x)} = 3^{-2}$$
$$3^{4x + 3(3-x)} = 3^{-2}$$
$$4x + 9 - 3x = -2$$
$$x = -2 - 9$$
$$x = -11$$

78

$$32^{1/5} = 2$$
$$\boxed{\log_{32} 2 = 1/5}$$

$$\log_b x = y \iff b^y = x$$

base log = base exponent

79 $\log_b 8 = 3$

$\boxed{8 = b^3}$

80 $\log_2 1 = \boxed{0}$ What power do you put on 2 to get 1?

81

$f(x) = \ln(\underline{\underline{3-x}})$ $\quad 3-x > 0$

>0 $\quad 3 > x$

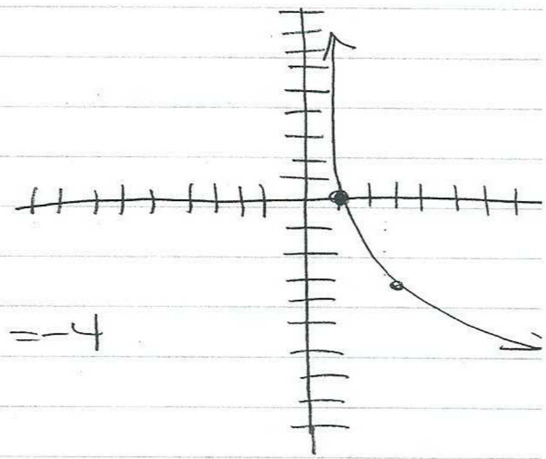
$\boxed{D: x < 3}$

82 $\boxed{f(x) = -4\ln x}$

start $(1,0)$
shift $\underline{(0,0)}$
$(1,0)$

$\underline{\text{VA}}$ $x = 0$

x	y
(1	0)
2	$-4\ln 2$
e	$-4\ln e = -4$



83 $\log_x\left(\frac{27}{64}\right) = 3$

$\frac{27}{64} = x^3$

$\boxed{\frac{3}{4} = x}$

86 $\log_2 2^{46.6}$

$46.6(\log_2 2)$

46.6

84 $\log_{28} 4 + \log_{28} 7$

$\log_{28}(4)(7) = \log_{28} 28 = 1$

85

$2 \ln e^{4.2}$

$2(4.2) \cancel{\ln e} \rightarrow 1$

8.4

(87) $\log_{19} \frac{\sqrt[3]{14}}{q^2 p} = \log_{19} \sqrt[3]{14} - \log_{19} q^2 - \log_{19} p$

$= \log_{19} 14^{1/3} - \log_{19} q^2 - \log_{19} p$

$= \boxed{\frac{1}{3}\log_{19} 14 - 2\log_{19} q - \log_{19} p}$

(88)

$(\log_a t - \log_a s) + 4\log_a u$

$\log_a t - \log_a s + \log_a u^4$

$\boxed{\log_a \frac{t \cdot u^4}{s}}$

(89) $\log_6 (2x+7) = \log_6 (2x+4)$

$2x+7 = 2x+4$

$7 = 4$ but $7 \neq 4$

so no soln.

(90) $3^{x-1} = 18$

$\ln 3^{x-1} = \ln 18$

$\boxed{x = \frac{\ln 18}{\ln 3} + 1}$

$(x-1)\ln 3 = \ln 18$

$x - 1 = \frac{\ln 18}{\ln 3}$

$\approx \boxed{3.63}$

(91) compounded continuously

$\boxed{A = Pe^{rt}}$

$A = (1565)e^{0.065(9/12)} = \boxed{\$1643.18}$

(92) 5.25% compounded continuously

triple

$3A = Ae^{0.0525t}$

$3 = e^{0.0525t}$

$\ln 3 = \ln e^{0.0525}$

$\ln 3 = 0.0525t \cancel{\ln e}^{1}$

$\frac{\ln 3}{0.0525} = t = 20.926\text{yrs}$

(93) $\left(\frac{1}{4}\right)^x = 13$ $\qquad$ $x = \frac{\ln 13}{\ln\left(\frac{1}{4}\right)} = \boxed{-1.85}$ $\qquad$ (16)

$\ln\left(\frac{1}{4}\right)^x = \ln 13$

$x \ln\left(\frac{1}{4}\right) = \ln 13$

(94) $\log_{4.5} 3.3 = \frac{\log 3.3}{\log 4.5} \cong \boxed{0.794}$

(95) $\log_6 26 \cdot \log_{26} 36$

$= \frac{\cancel{\log 26}}{\log 6} \cdot \frac{\log 36}{\cancel{\log 26}} = \frac{\log \overset{6^2}{36}}{\log 6} = \frac{2\log 6}{\log 6}$

$= 2$

(96) $\log_8 \frac{1}{512} = \log_8 8^{-3} = -3\underbrace{\log_8 8}_{1} = -3$

(97) $\log_{10}\sqrt{10} = \log_{10} 10^{1/2} = \frac{1}{2}\log_{10} 10 = \frac{1}{2}$

(98) $5^{\sqrt{5}} \cong \boxed{36.55}$

(99) $f(x) = 8 - 3x$ $\qquad$ $g(x) = \frac{x}{3}(x-8)$

$y = 8 - 3x$
$x = 8 - 3y$
$3y = 8 - x$
$y = \frac{8-x}{3} = \frac{1}{3}(8-x) \neq g(x)$

no

also, you could verify

$f(g(x)) = x$
$g(f(x)) = x$

If both are true, then f & g are inverses

100) $f(x) = \frac{x-6}{x}$ $\qquad g(f(2)) = g(-4)$

$g(x) = x^2+9$ $\qquad = (-4)^2+9$

$\qquad = 16+9 = \boxed{25}$

$f(2) = \frac{-2-6}{2} = \frac{-8}{2} = -4$ $\qquad \boxed{C}$

101) local maxima $\longrightarrow$ $(0,1)$
local minima $\longrightarrow$ $(-1,0)$ \$ $(1,0)$

102) $f(x) = \frac{3}{x+2}$ $\quad$ find $\frac{f(x)-f(1)}{x-1}$

$f(1) = \frac{3}{1+2} = \frac{3}{3} = 1$

$$\frac{f(x)-f(1)}{x-1} = \frac{\frac{3}{x+2} - 1}{x-1} = \frac{3-1(x+2)}{x(x+2)-1(x+2)}$$

lcd $= x+2$

$$= \frac{3-x-2}{x^2+2x-x-2} = \boxed{\frac{-x+1}{x^2+x-2}} = \frac{-\cancel{(x-1)}}{(x+2)\cancel{(x-1)}}$$

$$= \boxed{\frac{-1}{x+2}}$$

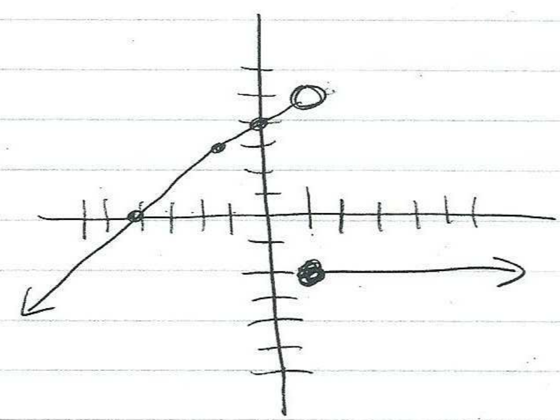
103) $f(x) = \begin{cases} x+4 & x<1 \\ -2 & x \geq 1 \end{cases}$

$y = x+4$
$x<1$

x	y
1	5
0	4
-1	3

open

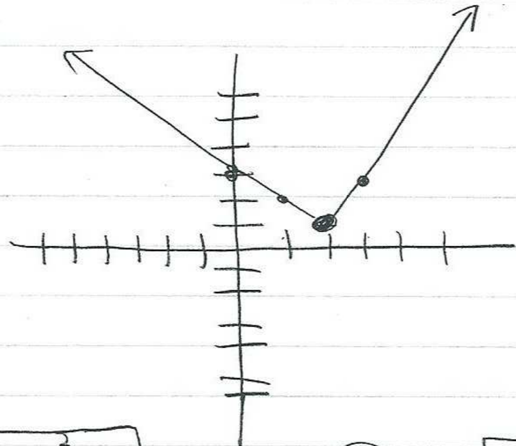
$y=-2$
Horizontal
closed



(104) $f(x) = \begin{cases} -x+3 & \text{if } x < 2 \\ 2x-3 & \text{if } x \geq 2 \end{cases}$

line
$y = -x+3$
$(x<2)$

x	y	
2	1	open
1	2	
0	3	



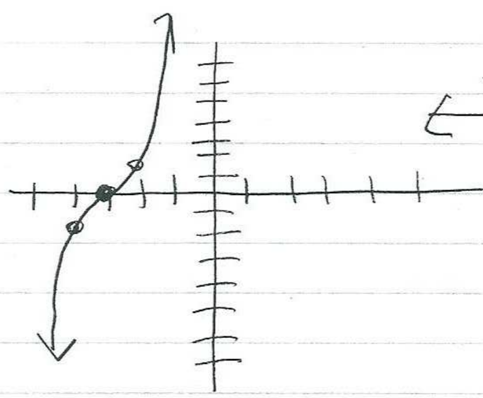
line
$y = 2x-3$
$(x \geq 2)$

x	y	
2	1	closed
3	3	
4	5	

(105) $\boxed{f(x) = (x+3)^3}$

"vertex"
$(-3,0)$

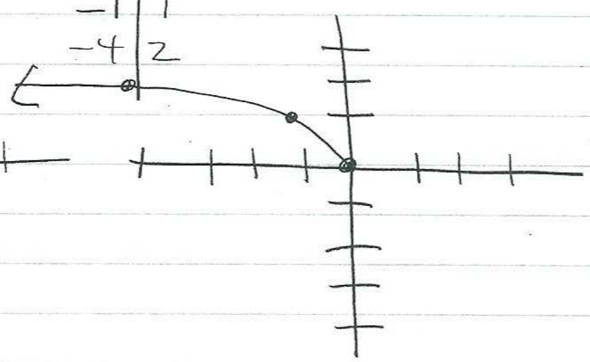
x	y
−6	−27
−4	−1
−3	0
−2	1
0	27



(106) $\boxed{f(x) = \sqrt{-x}}$

up / left
"vertex" $(0,0)$

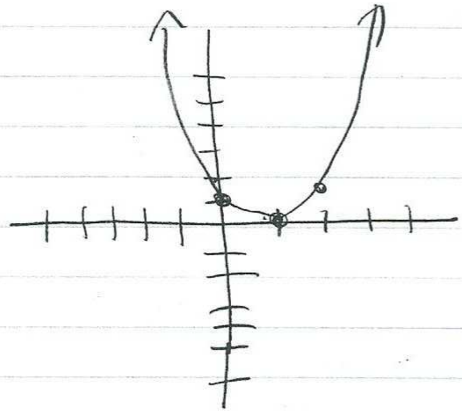
x	y
−1	1
−4	2



(107) $f(x) = x^2 - 2x + 1$
$f(x) = (x-1)^2$

vertex : $(1,0)$
up
standard

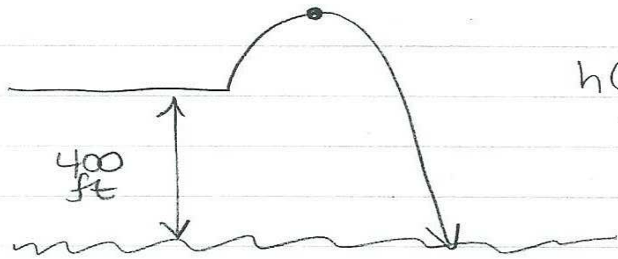
x	y
0	1
1	0
2	1



108 $f(x) = -x^2 + 2x - 8$

a) downward since $a = -1$, so it has a max. at the vertex

109



$$h(x) = \frac{-32x^2}{(360)^2} + x + 400$$

max height = vertex

$$h(x) = \frac{-32}{(360)^2}x^2 + x + 400$$

$$h = \frac{-b}{2a} = \frac{-1}{2\left(\frac{-32}{(360)^2}\right)} = \frac{-1}{2} \cdot \frac{360^2}{-32} = 2025$$

$$k = \frac{-32(2025)^2}{(360)^2} + (2025) + 400 = 1412.5$$

max height = y coord. of vertex = $\boxed{1412.5 \text{ ft}}$

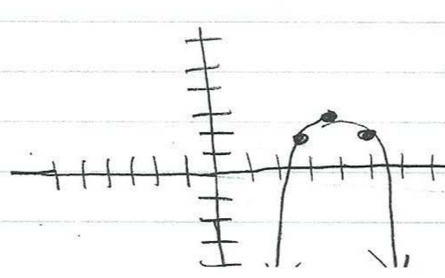
110 $f(x) = 9x^3 - 4x^2 - 8$ polynomial yes degree 3

111 $f(x) = 3 - \dfrac{2}{x^6}$ not a polynomial (variable in denominator)

112 $f(x) = -(x-4)^4 + 3$

like an x^2

(4,3) down standard



x	y
2	-13
3	2
4	3
5	2
6	-13

113 zeros: 2 mult 2
-2 mult 2
degree 4

$\boxed{f(x) = (x-2)^2 (x+2)^2}$

114 $f(x) = 3(x+7)(x+3)^2$

zeros	-7	-3
mult.	1	2
Cross/Touch	C	T

C (odd mult) T (even mult)

115 $f(x) = (x+6)(x-5)(x+5)$

$\boxed{\text{x-int}}$ $y=0$ $0=(x-6)(x-5)(x+5)$

$x=6$ $x=5$ $x=-5$

$(6,0)$ $(5,0)$ $(-5,0)$

$\boxed{\text{y-int}}$ $x=0$ $y=(0+6)(0-5)(0+5)$ $(0,-150)$

$= -150$

116 $h(x) = \dfrac{6x}{(x+7)(x-8)}$

Denom $\neq 0$

$(x+7)(x-8) \neq 0$

$\boxed{\text{D: } \mathbb{R} \text{ except } -7 \,\&\, 8}$

117 $h(x) = \dfrac{x+5}{x^2+1}$

$x^2+1 \neq 0$

doesn't factor, so no real restrictions

D: $\mathbb{R}$

118 $f(x) = \dfrac{3x+10}{x^2+12x+35}$

$(x+7)(x+5)$

VA $\boxed{x=-7}$ $\boxed{x=-5}$

119 $f(x) = \dfrac{x^4-1}{3x^5+3}$

$\dfrac{x^4}{3x^5} \Rightarrow \dfrac{1}{3x}$ num < denom

HA $\boxed{y=0}$

120 $\boxed{x\text{ int}}$ $y=0$

$$0 = \frac{(x-6)(2x+7)}{x^2+5x-9}$$

only the numerator can generate zero

$x-6=0$ $\quad$ $2x+7=0$

$x=6$ $\quad$ $x=-7/2$ $\quad$ $(-7/2, 0)$

$(6,0)$

121 $\boxed{y\text{-int}}$ $x=0$

$$f(x) = \frac{x^2-4}{x^2+2x-11} \qquad f(0) = \frac{0^2-4}{0^2+2(0)-11} = \frac{4}{11}$$

$$\boxed{(0, 4/11)}$$

122 $$f(x) = \frac{x^2+9x+9}{x+6}$$

$$\begin{array}{r} x+3 - 9/(x+6) \\ x+6 \,\overline{)\, x^2+9x+9} \\ -(x^2+6x) \\ \hline 3x+9 \\ -(3x+18) \\ \hline -9 \end{array}$$

Oblique asymptote is $y = x+3$

123 $V = 700\text{ cm}^3$

8¢ (top/bottom) sq cm. $\quad \pi r^2$ $\quad$ $\boxed{0.16\pi r^2 + \frac{70}{r}}$

5¢ (sides) $\quad h$

A

$$\text{Cost} = \underbrace{.16(\pi r^2)}_{\text{top + bottom at 8¢ each}} + \underbrace{0.05\left(\frac{1400}{r}\right)}_{\text{sides}} \qquad \frac{1400}{r}$$

For the side material, think about unrolling the material on the can.

The circumference of the bases $= 2\pi r$ $\quad$ substitute

Area of sides $= 2\pi rh$ $\quad$ $V = \pi r^2 h$ $\quad$ $700 = \pi r^2 h$ $\quad$ $\frac{700}{\pi r^2} = h$ $\quad$ $2\pi r h$ $\quad$ $2\pi r\left(\frac{700}{\pi r^2}\right)$

124

$f(x) = \frac{6}{x+6}$

$g(x) = x+9$

$f(g(x)) = f(x+9) = \frac{6}{(x+9)+6} = \frac{6}{x+15}$

$\mathbb{R}$ (no restrictions)

$$\boxed{f(g(x)) = \frac{6}{x+15} \quad (x \neq -15)}$$

125

$f(x) = \sqrt{x+1}$ $\quad f(g(1)) = f(5) = \sqrt{5+1} = \sqrt{6}$

$g(x) = 5x$

$g(1) = 5(1) = 5$

126

$f(x) = 8-5x$

$g(x) = \frac{x}{5}(x-8)$

$f(g(x)) = x$ &

$g(f(x)) = x$!

$f(g(x)) = f\left(\frac{x}{5}(x-8)\right) = 8 - \cancel{5}\left(\frac{x}{\cancel{5}}(x-8)\right)$

$= 8 - x^2 - 8x \neq x$

NO

127

$f(x) = 6x+6$

$y = 6x+6$

$x = 6y+6$

$x-6 = 6y$

$$\boxed{\frac{x-6}{6} = y = f^{-1}(x)}$$

128

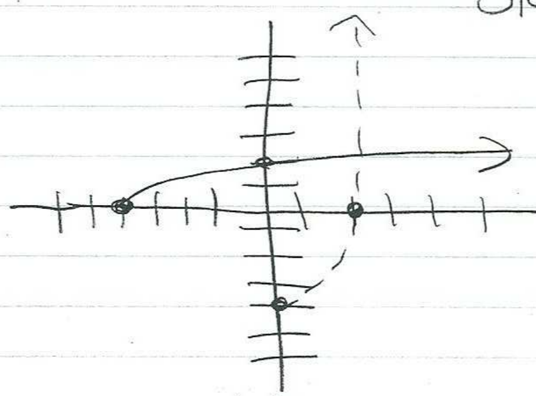
$4.2^{\pi} \cong 90.781$

129

$f(x) = \sqrt{x+4}$

$(-4,0)$ up/R

x	y
-4	0
0	2



Inverse

x	y
0	-4
2	0

130

$$2^{x^2-3} = 64$$
$$2^{x^2-3} = 2^{6}$$
$$x^2 - 3 = 6$$
$$x^2 = 9$$
$$x = \pm\sqrt{9} = \pm 3$$

131

$$e^x = 14$$
$$\ln e^x = \ln 14$$
$$x \cancel{\ln e}^{1} = \ln 14$$
$$x = \ln 14$$

132

$$\log_4 \frac{1}{64} = \log_4 4^{-3}$$
$$= -3\log_4 4 = -3$$

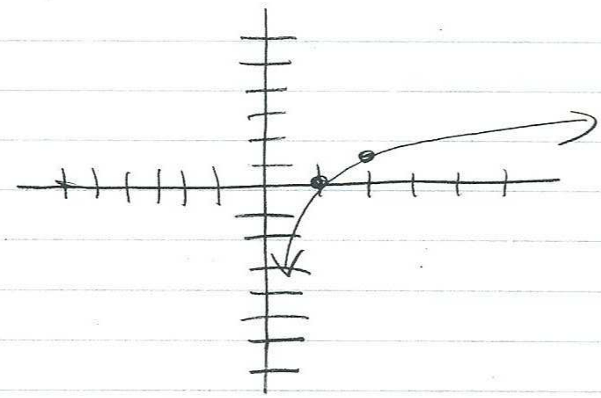
133

$$y = \log_2 x$$

start (1,0)
shift (0,0)
1,0

VA $x = 0$

x	y
1	0
2	1
4	2



134

$$6^{\log_6 4.19} = \boxed{4.19}$$

property of logs
$$a^{\log_a x} = x$$

135

$$\log_3 x + \log_3 (x-24) = 4$$
$$\log_3 x(x-24) = 4$$
$$x(x-24) = 3^4$$
$$x^2 - 24x = 81$$
$$x^2 - 24x - 81 = 0$$
$$(x-27)(x+3) = 0$$
$$\boxed{x = 27} \quad \boxed{\cancel{x = -3}}$$

$\log_3(-3) = $ undef.

$x = 27$

136

$4^{x-1} = 14$

$\ln 4^{x-1} = \ln 14$

$(x-1)\ln 4 = \ln 14$

$x - 1 = \dfrac{\ln 14}{\ln 4}$

$x = \dfrac{\ln 14}{\ln 4} + 1$

$\approx \boxed{2.90}$

137 $f(x) = 4(x-4)(x-3)^2$

zeros	4	3
mult	1	2
C/T	C	T

138 $f(x) = \left(x + \frac{1}{6}\right)^4 (x-3)^5$

x-int $-1/6$, 3
T C

$-$ | $-1/6$ | $-$ | 3 | $+$

test -1

$(-1+1/6)^4(-1-3)^5$

$(-)^4(-)^5$

$(-)^9 = -$

below $(-\infty, -1/6)$ $(-1/6, 3)$
above $(3, \infty)$

139

	x	(x−1)	(x−2)
zeros	0	1	2
C/T	C	T	C
	odd	even	odd.

odd $-x$ → only A or C will work
even $-(x-1)$ → now only A will work

A

140 $f(x) = \dfrac{x+6}{x^2+16x}$ $\boxed{\mathbb{R} \text{ except } 0, -16}$ 25

$x(x+16)$

141 $\boxed{VA}$ $f(x) = \dfrac{3x-7}{x^2-5x-14}$ $\boxed{x=7}$ $\boxed{x=-2}$

$(x-7)(x+2)$

142 $\boxed{HA}$ $f(x) = \dfrac{7x^2-3x-7}{2x^2-7x+5}$ $\dfrac{7x^2}{2x^2} \Rightarrow \dfrac{7}{2}$

$\boxed{y=\frac{7}{2}}$

143 ① $6x+3y=51$

② $2x-6y=38$

① $6x+3y=51$

-3 ② $-6x+18y=-114$

$21y=-63$

$y=-3$

$2x-6y=38$

$2x-6(-3)=38$

$2x=38-18$

$2x=20$

$x=10$

$\boxed{(10,-3)}$

144 $3x+y=-2$

$3(-2)+(4)=-2$

$-6+4=-2$

$-2=-2$ ✓

$2x+3y=8$

$2(-2)+3(4)=8$

$-4+12=8$

$8=8$ ✓

145 ① $5x-2y=-1$

② $x+4y=35$

① $5x-2y=-1$

-5 ② $-5x-20y=-175$

$-22y=-176$

$y=8$

$x+4y=35$

$x+4(8)=35$

$x=3$

$\boxed{(3,8)}$

147 ① $2x^2+y^2=17$
② $3x^2-2y^2=-6$

$3①\quad 6x^2+3y^2=51$
$-2②\quad -6x^2+4y^2=12$

$7y^2=63$
$y^2=9$
$y=\pm3$

$\boxed{y=3}$ $2x^2+y^2=17$
$2x^2+(3)^2=17$
$2x^2=8$
$x^2=4$
$x=\pm2$
$\boxed{(2,3)\quad(-2,3)}$

$\boxed{y=-3}$ $2x^2+y^2=17$
$2x^2+(-3)^2=17$
$2x^2+9=17$
$2x^2=8$
$x^2=4$
$x=\pm2$
$\boxed{(2,-3)\quad(-2,-3)}$

149 see other <u>sheet</u> 26
use test points!!

146 $\boxed{\begin{array}{c}3x^2+2y^2=89\\ x^2-2y^2=-21\end{array}}$

$3x^2+2y^2=89$
$x^2-2y^2=-21$
$4x^2=68$
$x^2=17$
$x=\pm\sqrt{17}$

$\boxed{x=\sqrt{17}}$ $x^2-2y^2=-21$
$(\sqrt{17})^2-2y^2=-21$
$17-2y^2=-21$
$-2y^2=-38$
$y^2=19$
$y=\pm\sqrt{19}$
$\boxed{(\sqrt{17},\sqrt{19})\quad(\sqrt{17},-\sqrt{19})}$

$\boxed{x=-\sqrt{17}}$ $x^2-2y^2=-21$
$(-\sqrt{17})^2-2y^2=-21$
$17-2y^2=-21$
$-2y^2=-38$
$y^2=19$
$y=\pm\sqrt{19}$
$\boxed{(-\sqrt{17},\sqrt{19})\quad(-\sqrt{17},-\sqrt{19})}$

148 $x-y>-5$

x	y
0	5
-5	0

test $(0,0)$ $0>-5$ true