Math 131 – Prof. Richard B. Goldstein – Stewart 6e – Chap 1 HW

Sect 1.1

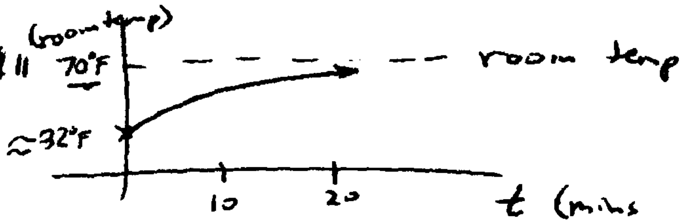
#1 $f(-1) = \underline{\underline{-2}}$ $\quad f(2) \approx \underline{\underline{2.8}}$ $\quad \left.\begin{matrix} f(-3)=2 \\ f(\underline{1})=2 \end{matrix}\right\}$ $\quad f(-\underline{\underline{2.5}}) = f(\underline{\underline{0.3}}) = 0$

$\mathcal{D}(f) = [-3,3]$, range of f $[-2,3]$, f incr on $[-1,3]$

#7 function – yes $\quad \mathcal{D}(f) = [-3,2]$ $\quad$ note $f(-2) = -1$

range of f $\quad [-3,-2) \cup [-1,3]$

#11



#27 $f(x) = \frac{x}{3x-1}$ $\quad 3x-1 \neq 0$ $\quad x \neq 1/3$ $\quad \therefore \mathcal{D}(f) = (-\infty, \frac{1}{3}) \cup (\frac{1}{3}, \infty)$

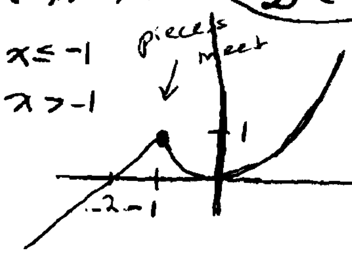
#29 $f(t) = \sqrt{t} + \sqrt[3]{t}$ $\quad$ only $\sqrt{t}$ presents a problem: $t \geq 0$

$\mathcal{D}(f) = [0, \infty)$

#31 $h(x) = \frac{1}{\sqrt[4]{x^2-5x}}$ $\quad \mathcal{D}(h) = (-\infty,0) \cup (5,\infty)$ $\quad \leftarrow \underline{x^2-5x>0}$

#43 $f(x) = \begin{cases} x+2 & \text{if } x \leq -1 \\ x^2 & \text{if } x > -1 \end{cases}$

$\mathcal{D}(f) = (-\infty, \infty)$



note: $f(-1) = -1+2 = 1$

and f approaches 1 as x approaches -1

(important when limits are discussed)

Sect 1.2

#1 (a) $f(x) = \sqrt[5]{x} = x^{1/5}$ $\quad$ power function (root)

(b) $g(x) = \sqrt{1-x^2}$ $\quad$ algebraic function

(c) $h(x) = x^9 + x^4$ $\quad$ power functions (polynomial)

(d) $r(x) = \frac{x^2+1}{x^3+x}$ $\quad$ rational function (note: if $x \neq 0$ reduces to $\frac{1}{x} = x^{-1}$ a power function)

(e) $s(x) = \tan 2x$ $\quad$ trig.

(f) $t(x) = \log_{10} x$ $\quad$ logarithmic

#3 (a) $y = x^2$ – blue (h) (even)

(b) $y = x^5$ – red (f) (odd)

(c) $y = x^8$ – black (g) (even)

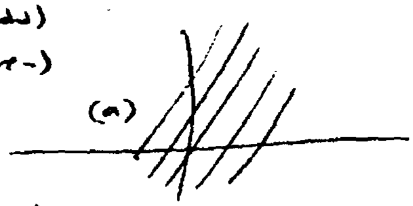
#5 (a) $y = 2x + b$

(b) $f(2) = 1$ $\quad y - 1 = m(x-2)$

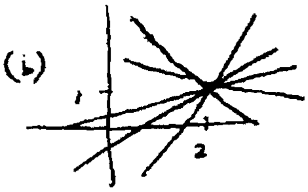
$y = mx - 2m + 1$

(c) $y = 2(x-2)+1 = 2x - 3$

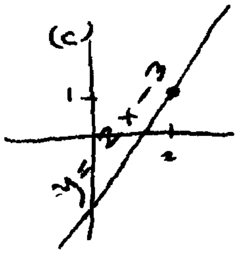
(a)



(b)



(c)



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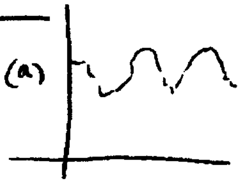
Sect 1.2

#19 (a)

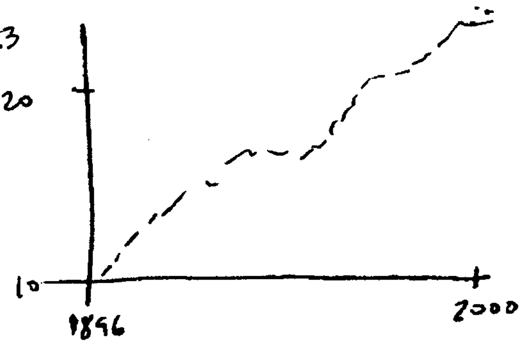


trigonometric function such as sin, cos

(b)

linear

#23



linear model

* using least sqs $\approx$ $y = 0.089x - 158.24$

$x =$ yr $\quad y =$ ht in ft

$y(2000) \approx 20.0$ ft (actually was less than 1996)

$y(2100) \approx 28.9$ ft (unlikely?)

Sect 1.3

#3 (a) $f(x-4)$ right by 4 units ③

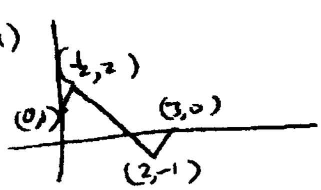
(b) $f(x)+3$ up by 3 units ①

(c) $\frac{1}{3}f(x)$ $\frac{1}{3}$ height ④

(d) $-f(x+4)$ left by 4 units + reflection ⑤

(e) $2f(x+6)$ left by 6 units + 2x height ②

#5 (a)

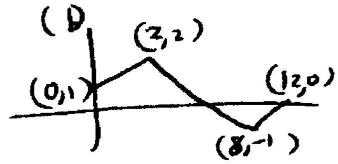


$f(2x)$

$(0,1) \to (0,1)$
$(1,2) \to (\frac{1}{2}, 2)$
$(4,-1) \to (2,-1)$
$(6,0) \to (3,0)$

squeezed left-right

(b)

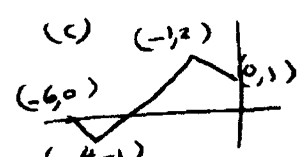


$f(\frac{1}{2}x)$

$(0,1) \to (0,1)$
$(1,2) \to (2,2)$
$(4,-1) \to (8,-1)$
$(6,0) \to (12,0)$

expanded left-right

(c)

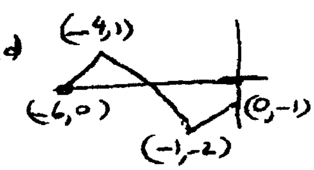


$f(-x)$

$(0,1) \to (0,1)$
$(1,2) \to (-1,2)$
$(4,-1) \to (-4,-1)$
$(6,0) \to (-6,0)$

reflected in y-axis

(d)

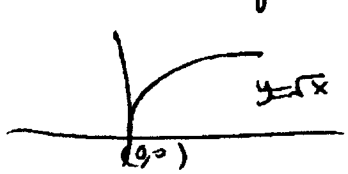


$-f(-x)$

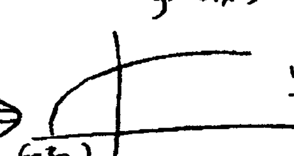
$(0,1) \to (0,-1)$
$(1,2) \to (-1,-2)$
$(4,-1) \to (-4,1)$
$(6,0) \to (-6,0)$

reflected in y, then x-axis

#17 $y = \sqrt{x+3}$



$\Rightarrow$



$y = \sqrt{x+3}$
graph moves left by 3 units

Sect 1.3

#33 $f(x) = 1-3x$ $\quad g(x) = \cos x$

(a) $f \circ g(x) = 1 - 3\cos x$

(b) $g \circ f(x) = \cos(1-3x)$

(c) $f \circ f(x) = 1 - 3(1-3x) = -2 + 9x$

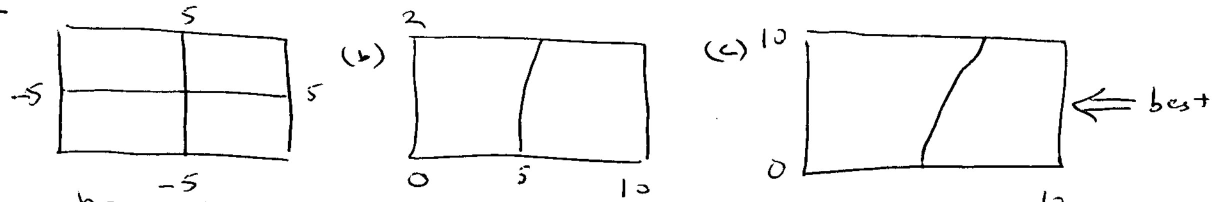
(d) $g \circ g(x) = \cos(\cos x)$

$\mathcal{D}$ for f, g is $\mathbb{R}$ and the same for all (a) to (d)

#43 $F(x) = \dfrac{\sqrt[3]{x}}{1+\sqrt[3]{x}}$ let $f(x) = \dfrac{x}{1+x}$ $\quad g(x) = \sqrt[3]{x}$

Sect 1.4

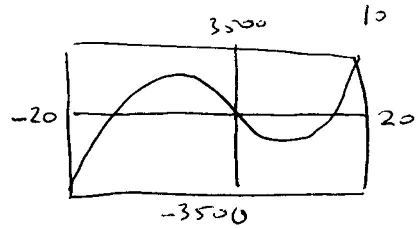
#1 $f(x) = \sqrt{x^3 - 5x^2} = \sqrt{x^2(x-5)}$



no graph

#7 $f(x) = x^3 - 225x = x(x^2-225) = x(x+15)(x-15)$

$f(-20) = -3500 \quad f(20) = 3500$

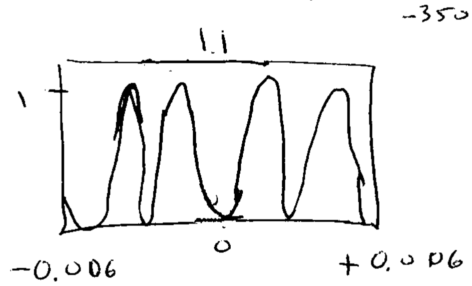


#9 $f(x) = \sin^2(1000x)$

period is $\frac{2\pi}{1000} \sim 0.0063$

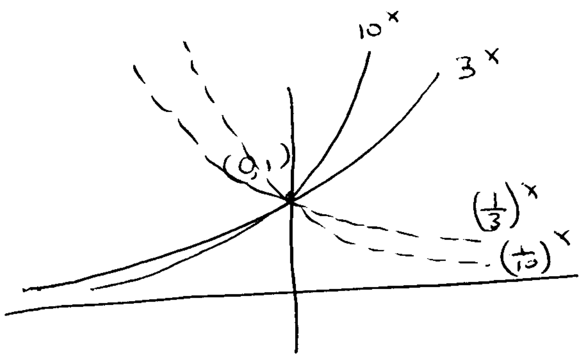
range is $[-1, 1]$ for sin

and $[0, 1]$ for $\sin^2$

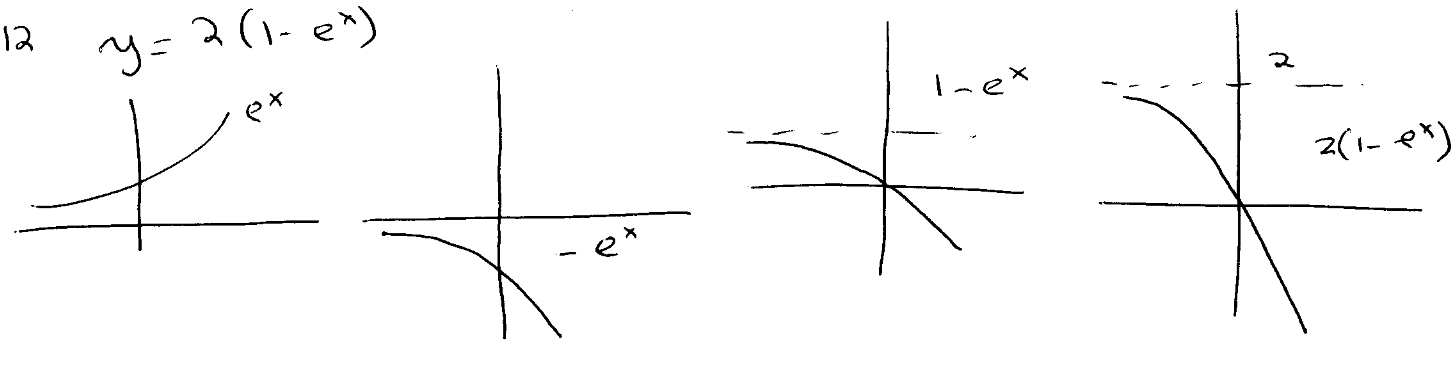


Sect 1.5

#5



#12 $y = 2(1-e^x)$



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Sect 1.5

#15 (a) $f(x)=\frac{1}{1+e^x}$ since $e^x>0\ \forall x$ the domain is $\underline{\mathbb{R}}$

(b) $f(x)=\frac{1}{1-e^x}$ since $1-e^x=0$ when $e^x=1$ at $x=0$ the domain is $\underline{(-\infty,0)\cup(0,\infty)}$

#25 bacteria pop. doubles every three hours $P(0)=100$

(a) $P(15) \Rightarrow$ 5 doubling periods $2^5=32$ $P(5)=100\cdot 32=\underline{3,200}$

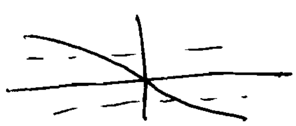
(b) t hours then $t/3$ doubling periods

$$\underline{P(t)=100\cdot 2^{t/3}}$$

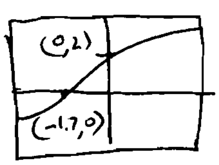
(c) $P(20)=100\ 2^{20/3}\cong 10,159$

(d) $P(t)=50000 \Rightarrow 100\cdot 2^{t/3}=50000 \Rightarrow 2^{t/3}=500$ trial + error $\underline{t\approx 26.9 \text{ hrs}}$

Sect 1.6

#5  no horizontal line intersects f more than once $\therefore$ f is 1-1

#7  fails horizontal test $\Rightarrow$ not 1-1

#18 

(a) passes 1-1 test

(b) domain of $f=[-3,3]=$ range of f^{-1}
range of $f=[-1,3]=$ domain of f^{-1}

(c) $f^{-1}(2)=0$ (d) $f^{-1}(0)\approx -1.7$ (visual est.)

#21 $y=\sqrt{10-3x} \Rightarrow 10-3x=y^2 \Rightarrow x=-\frac{1}{3}y^2+\frac{10}{3}$ $\therefore \underline{f^{-1}(x)=-\frac{1}{3}x^2+\frac{10}{3}}$

#35 (a) $\log_2 6-\log_2 15+\log_2 20=\log_2\frac{6\cdot 20}{15}=\log_2 8=\underline{3}$

(b) $\log_3 100-\log_3 18-\log_3 50=\log_3\frac{100}{18\cdot 50}=\log_3\left(\frac{1}{9}\right)=\log_3(3)^{-2}=\underline{-2}$

#49 (a) $2^{x-5}=3$ $\log_2 3=x-5 \Rightarrow \underline{x=5+\log_2 3}=\underline{5+\frac{\ln 3}{\ln 2}}$

(b) $\ln x+\ln(x-1)=1 \Rightarrow x(x-1)=e^1 \Rightarrow x^2-x-e=0$ $x=\frac{1}{2}(1\pm\sqrt{1+4e})$

$\underline{\text{reject}}$ negative root $\therefore x=\frac{1}{2}(1+\sqrt{1+4e})$
$\underline{\sim 2.2287}$