Section 4.1

2)

t (min)	distance (miles)
2	1.4
12	0.9

calculate slope

$m = \frac{(0.9)-(1.4)}{(12)-(2)} = \frac{-0.5}{10} = -0.05$

her rate is -0.05 miles per minute

4) when 2 lines are perpendicular ($\perp$) the slopes satisfy the equation $m_2 = \frac{-1}{m_1}$ or $m_1 m_2 = -1$.
no restriction on y-intercepts.

6) $y = \frac{1}{4}x + 6$ yes

8) $y = 3x^2 - 2$ no

10) $3x^2 + 5y = 15$ no

12) $-2x^2 + 3y^2 = 6$ no

14) $f(x) = 4x + 3$ $m = 4 > 0$ Increasing

16) $a(x) = 5 - 2x = -2x + 5$ $m = -2 < 0$ decreasing

18) $h(x) = -2x + 4$ $m = -2 < 0$ decreasing

20) $j(x) = \frac{1}{2}x - 3$ $m = \frac{1}{2} > 0$ Increasing

22) $m(x) = -\frac{3}{8}x + 3$ $\quad m = \frac{-3}{8} < 0$ decreasing

24) (2,4) and (4,10) $\quad m = \frac{(10)-(4)}{(4)-(2)} = \frac{6}{2} = 3$

26) (-1,4) and (5,2) $\quad m = \frac{(2)-(4)}{(5)-(-1)} = \frac{-2}{6} = \frac{-1}{3}$

28) (6,11) and (-4,3) $\quad m = \frac{(3)-(11)}{(-4)-(6)} = \frac{-8}{-10} = \frac{4}{5}$

30) $f(-1) = 4 \rightarrow (-1,4)$ $\quad f(5) = 1 \rightarrow (5,1)$

$m = \frac{(1)-(4)}{(5)-(-1)} = \frac{-3}{6} = \frac{-1}{3}$

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

$y - (1) = \frac{-1}{3}(x - (5))$ | $y = \frac{-1}{3}x + \frac{8}{3}$

$y - 1 = \frac{-1}{3}x + \frac{5}{3}$ | $f(x) = \frac{-1}{3}x + \frac{8}{3}$

$y = \frac{-1}{3}x + \frac{5}{3} + 1$ |

32) passes (1,5) and (4,11)

$m = \frac{(11)-(5)}{(4)-(1)} = \frac{6}{3} = 2$

$y - (5) = 2(x - (1))$ | $y = 2x + 3$

$y - 5 = 2x - 2$ | $f(x) = 2x + 3$

34) passes $(-2,8)$ and $(4,6)$

$$m=\frac{(6)-(8)}{(4)-(-2)}=\frac{-2}{6}=\frac{-1}{3}$$

$y-(6)=\frac{-1}{3}(x-(4))$ | $y=\frac{-1}{3}x+\frac{4}{3}+6$

$y-6=\frac{-1}{3}x+\frac{4}{3}$ | $y=\frac{-1}{3}x+\frac{22}{3}$

$f(x)=\frac{-1}{3}x+\frac{22}{3}$

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36) x-int.: $(-5,0)$; y-int.: $(0,4)$

$$m=\frac{(4)-(0)}{(0)-(-5)}=\frac{4}{5}$$

$y-(4)=\frac{4}{5}(x-(0))$ | $y=\frac{4}{5}x+4$

$y-4=\frac{4}{5}x$ | $f(x)=\frac{4}{5}x+4$

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38) $3y+x=12 \rightarrow 3y=-x+12 \rightarrow y=\frac{-1}{3}x+4 \rightarrow m_1=\frac{-1}{3}$

$-y=8x+1 \rightarrow y=-8x-1 \rightarrow m_2=-8$

$\frac{-1}{3}=m_1 \neq m_2=-8$, $-8=m_2 \neq \frac{-1}{m_1}=\frac{-1}{(\frac{-1}{3})}=3$ neither

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40) $6x-9y=10 \rightarrow 6x-10=9y \rightarrow \frac{2}{3}x-\frac{10}{9}=y \rightarrow m_1=\frac{2}{3}$

$3x+2y=1 \rightarrow 2y=-3x+1 \rightarrow y=\frac{-3}{2}x+\frac{1}{2} \rightarrow m_2=\frac{-3}{2}$

$\frac{2}{3}=m_1 \neq m_2=\frac{-3}{2}$, $\frac{-3}{2}=m_2=\frac{-1}{m_1}=\frac{-1}{(\frac{2}{3})}=\frac{-3}{2}$ perpendicular

42) $g(x) = 2x+4$

y-int: $g(0) = 2(0)+4 = \underline{4}$

x-int: $0 = g(x) = 2x+4$

$-4 = 2x$

$\underline{-2 = x}$

44) $k(x) = -5x+1$

y-int: $k(0) = -5(0)+1 = \underline{1}$

x-int: $0 = k(x) = -5x+1$

$5x = 1$

$\underline{x = \frac{1}{5}}$

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46) $7x+2y = 56$

y-int: $7(0)+2y = 56$

$2y = 56$

$\underline{y = 28}$

x-int: $7x+2(0) = 56$

$7x = 56$

$\underline{x = 8}$

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48) line 1: $(-8,-55)$ and $(10,89)$ $m_1 = \frac{(89)-(-55)}{(10)-(-8)} = \frac{144}{18} = \frac{72}{9} = 8$

line 2: $(9,-44)$ and $(4,-14)$ $m_2 = \frac{(-14)-(-44)}{(4)-(9)} = \frac{30}{-5} = -6$

$8 = m_1 \neq m_2 = -6$, $-6 = m_2 \neq \frac{-1}{m_1} = \frac{-1}{(8)} = \frac{-1}{8}$ neither

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50) line 1: $(1,7)$ and $(5,5)$ $m_1 = \frac{(5)-(7)}{(5)-(1)} = \frac{-2}{4} = \frac{-1}{2}$

line 2: $(-1,-3)$ and $(1,1)$ $m_2 = \frac{(1)-(-3)}{(1)-(-1)} = \frac{4}{2} = 2$

$-\frac{1}{2} = m_1 \neq m_2 = 2$, $2 = m_2 = \frac{-1}{m_1} = \frac{-1}{(-\frac{1}{2})} = 2$

perpendicular

52) parallel (||) to $f(x) = -5x - 3$ $(2, -12)$

$m_1 = -5$, $m_2 = m_1 = -5$

$y - (-12) = -5(x - (2))$

$y + 12 = -5x + 10$

$\underline{y = -5x - 2}$

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54) perpendicular ($\perp$) to $h(t) = -2t + 4$ $(-4, -1)$

$m_1 = -2$, $m_2 = \frac{-1}{m_1} = \frac{-1}{(-2)} = \frac{1}{2}$

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

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

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

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

$\underline{y = \frac{1}{2}t + 1}$

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56) use points $(0, 5)$ and $(4, 0)$

$m = \frac{(0) - (5)}{(4) - (0)} = \underline{\frac{-5}{4}}$

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58) use points $(0, 1)$ and $(3, 3)$

$m = \frac{(3) - (1)}{(3) - (0)} = \frac{2}{3}$

$y - (1) = \frac{2}{3}(x - (0))$

$y - 1 = \frac{2}{3}x$

$\underline{y = \frac{2}{3}x + 1}$

60) use points $(0,3)$ and $(1,1)$

$$m = \frac{(1)-(3)}{(1)-(0)} = \frac{-2}{1} = -2$$

$$y-(3) = -2(x-(0))$$

$$y-3 = -2x$$

$$\underline{\underline{y = -2x+3}}$$

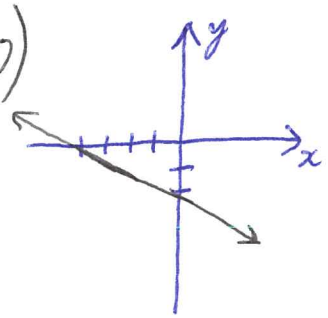
62) horizontal line: $m=0$ $\underline{\underline{y=3}}$

64) $f(x) = -x-1 \rightarrow$ E

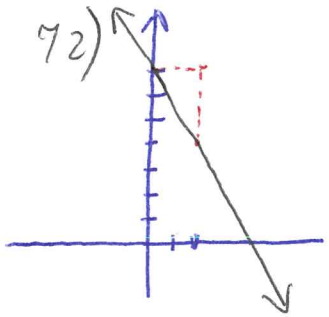
66) $f(x) = \frac{-1}{2}x-1 \rightarrow$ D

68) $f(x) = 2+x = x+2 \rightarrow$ B

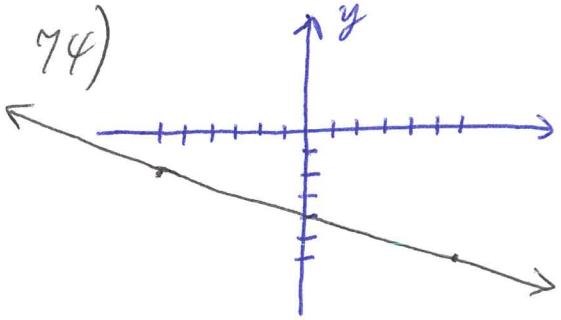
70)



72)

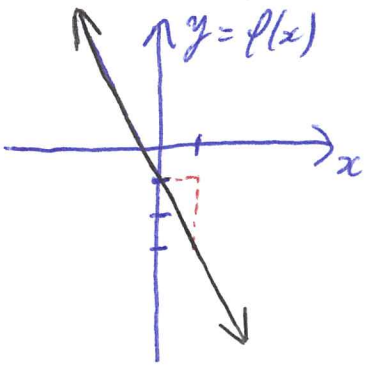


74)



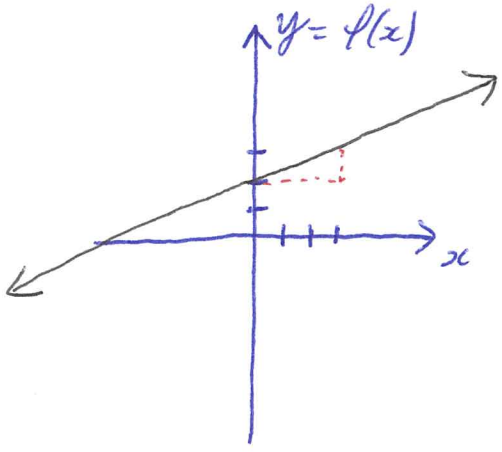
76) $f(x) = -2x-1$

$m = -2 = \frac{-2}{1}$ $b = -1$



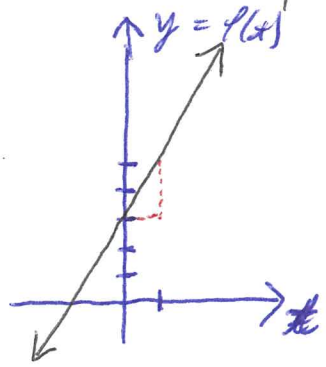
78) $f(x) = \frac{1}{3}x+2$

$m = \frac{1}{3}$ $b = 2$

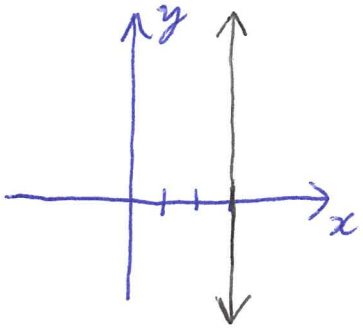


80) $f(t) = 3 + 2t = 2t + 3$

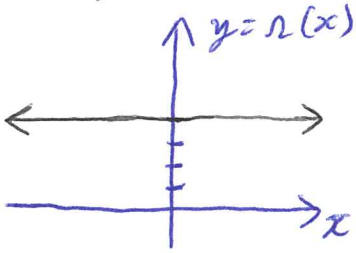
$m = 2 = \frac{2}{1}$ $\quad b = 3$



82) $x = 3$



84) $n(x) = 4$



86) $y = -1$

88) $x = 2$

90) $(0, 5)$ and $(5, 30)$ $\quad m_a = \frac{(30)-(5)}{(5)-(0)} = \frac{25}{5} = 5$

$(0, 5)$ and $(10, 105)$ $\quad m_b = \frac{(105)-(5)}{(10)-(0)} = \frac{100}{10} = 10$

$m_a \neq m_b \rightarrow$ not linear

92) $(5, 13)$ and $(10, 28)$ $\quad m_a = \frac{(28)-(13)}{(10)-(5)} = \frac{15}{5} = 3$

$(5, 13)$ and $(20, 58)$ $\quad m_b = \frac{(58)-(13)}{(20)-(5)} = \frac{45}{15} = 3$

$m_a = m_b \rightarrow$ linear

$y - (13) = 3(x - (5))$

$y - 13 = 3x - 15$

$y = 3x - 2$

$k(x) = 3x - 2$

94) (2,13) and (4,23) $m_a = \frac{(23)-(13)}{(4)-(2)} = \frac{10}{2} = 5$

(2,13) and (8,43) $m_b = \frac{(43)-(13)}{(8)-(2)} = \frac{30}{6} = 5$

$m_a = m_b \rightarrow$ linear

$y-(13) = 5(x-(2))$

$y-13 = 5x-10$

$y = 5x+3$

$h(x) = 5x+3$

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96) (0,6) and (2,31) $m_a = \frac{(31)-(6)}{(2)-(0)} = \frac{25}{2}$

(0,6) and (6,106) $m_b = \frac{(106)-(6)}{(6)-(0)} = \frac{100}{6} = \frac{50}{3}$

$m_a \neq m_b \rightarrow$ not linear

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skip 97-113

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114) $b = \$20$, $m = \$0.50$ per customer

$T(n) = 0.50n+20$

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116) (1000, 30) and (3000, 22)

$m = \frac{(22)-(30)}{(3000)-(1000)} = \frac{-8}{2000} = \frac{-4}{1000} = \frac{-2}{500} = \frac{-1}{250}$

$y-(30) = \frac{-1}{250}(x-(1000))$

$y-30 = \frac{-1}{250}x + \frac{1000}{250}$

$y-30 = \frac{-1}{250}x+4$

$y = \frac{-1}{250}x+34$

$p(n) = \frac{-1}{250}n+34$

118) (30 stalks, 30 oz) and (34 stalks, 28 oz)

$m = \frac{(28)-(30)}{(34)-(30)} = \frac{-2}{4} = \frac{-1}{2}$

$y-(30) = \frac{-1}{2}(x-(30))$

$y-30 = \frac{-1}{2}x+15$

$y = \frac{-1}{2}x+45$

$y = \frac{-1}{2}x+45$

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120) 2003 → $t=0$ and $P(t)=45000$ or $(0, 45000) \rightarrow b=45000$

$m = 1700$ people per year $\quad P(t) = 1700t + 45000$

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122) (0°C, 32°F) and (100°C, 212°F)

a) $m = \frac{(212)-(32)}{(100)-(0)} = \frac{180}{100} = \frac{18}{10} = \frac{9}{5}$

$y-(32) = \frac{9}{5}(x-(0))$

$y-32 = \frac{9}{5}x$

$y = \frac{9}{5}x+32$

$F(C) = \frac{9}{5}C+32$

b) $F(28) = \frac{9}{5}(28)+32 = \frac{252}{5}+\frac{160}{5} = \frac{412}{5} = \frac{824}{10} = 82.4$

when Celcius temperature is 28°C, its Fahrenheit temperature is 82.4°F

c) $F(-40) = \frac{9}{5}(-40)+32 = 9(-8)+32 = -72+32 = -40$

when Celcius temperature is -40°C, its Fahrenheit temperature is -40°F

this is when Celcius and Fahrenheit have same value of temperature.