09-16-25 MTH 167-004N

1.7 Transformations

1.7.1 Exercises

page 140 (152): 1,4, 19, 24, 48, 56

2 Linear and Quadratic Functions

2.1 Linear Functions

2.1.1 Exercises

page 163 (175): 5, 7, 15, 18, 26, 28, 32, 35, 45

Exam 1: 1.1-1.7, 2.1

2.1: 35

35. Water freezes at 0° Celsius and 32° Fahrenheit and it boils at 100°C and 212°F.

(a) Find a linear function F that expresses temperature in the Fahrenheit scale in terms of degrees Celsius. Use this function to convert 20°C into Fahrenheit.

(b) Find a linear function C that expresses temperature in the Celsius scale in terms of degrees Fahrenheit. Use this function to convert 110°F into Celsius.

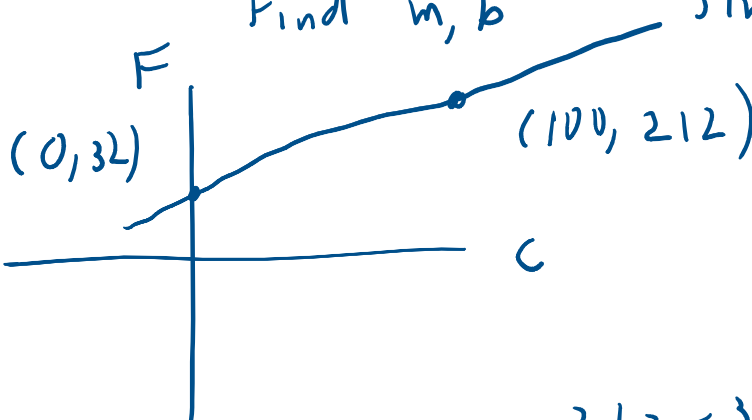
(c) Is there a temperature n such that $F(n) = C(n)$?

function $f(x) = mx + b$

(a) Remember linear

$F(c) = mc + b$

Find m, b stright line



$\boxed{b = 32}$ $m = \dfrac{212 - 32}{100 - 0} = \dfrac{180}{100} = \dfrac{18}{10} = \boxed{\dfrac{9}{5} = m}$

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

Good notation

$\frac{9C}{5} = \left(\frac{9}{5}\right)C$

bad notation

$9/_5\, C$?

convert $20^\circ C$ to F°

$F(20) = \frac{9(20)}{5} + 32$

$= 36 + 32$

$= \boxed{68}$

$20^\circ C$ is equivalent to $68^\circ F$.

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

solve for C

$\frac{9C}{5} = F - 32$

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

(c) $F(n) = C(n)$

solve for n or show no such n exists

$\frac{9n}{5} + 32 = \frac{5}{9}(n - 32)$

$\frac{9n}{5}(45) + (32)(45) = \left(\frac{5}{9}\right)(45)(n-32)$

$81n + (32)(45) = 25(n-32)$

$$81n + (32)(45) = 25(n-32)$$
$$(81-25)n = -25(32) - (32)(45)$$
$$56n = 32(-25-45)$$
$$56n = -32(70)$$
$$n = -\frac{\cancel{32}^{4}}{\cancel{56}_{7}}(70)$$
$$n = -(4)\left(\frac{70}{7}\right)$$
$$n = -(4)(10)$$
$$\boxed{n = -40}$$

2.1: 28

28. Jeff can walk comfortably at 3 miles per hour. Find a linear function d that represents the total distance Jeff can walk in t hours, assuming he doesn't take any breaks.

$d = rt$

d = distance (miles)

r = rate ($\frac{mi}{hr}$)

t = time (hours)

given $r = 3\frac{mi}{hr}$

$$\boxed{d = \left(3\frac{mi}{hr}\right)t}$$

Let $t = 5$ hr

$d(5) = \left(3\frac{mi}{\cancel{hr}}\right)(5\ \cancel{hr})$

Let $t = 5$ hr

$$d(5\,hr) = \left(3\,\frac{mi}{\cancel{hr}}\right)(5\,\cancel{hr})$$

$$\boxed{d(5\,hr) = 15\,mi}$$

2.1

32. A salesperson is paid \$200 per week plus 5% commission on her weekly sales of x dollars. Find a linear function that represents her total weekly pay, W (in dollars) in terms of x. What must her weekly sales be in order for her to earn \$475.00 for the week?

$$w(x) = mx + b$$

Find m, b

$b = \$200$

$m = 0.05 = 5\%$

$$\boxed{w(x) = 0.05x + 200}$$

Find x such that $w(x) = \$475.00$

$$0.05x + 200 = 475$$

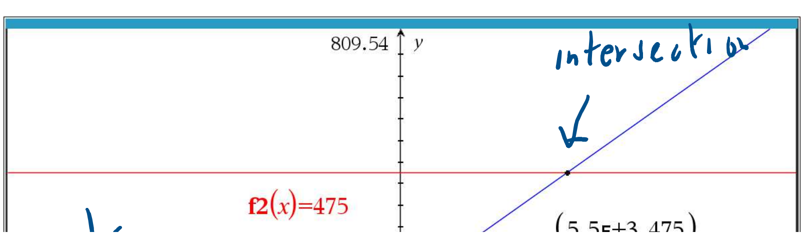
$$0.05x = 475 - 200$$

$$0.05x = 275$$

$$x = \frac{275}{0.05} = \boxed{5500 = x}$$

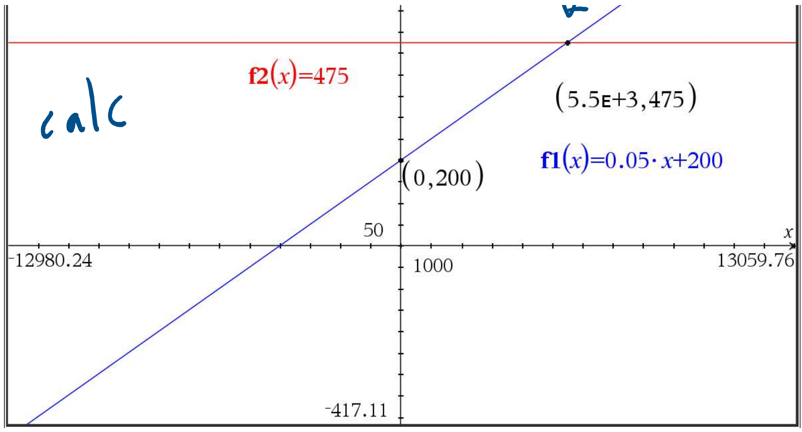
275/0.05=5,500.0

If weekly sales are \$5500, salesperson earns \$475 for that week.



$x = 5.5E+3$

$= 5.5 \times 10^3$



calc

$x = 5.5E+3$

$= 5.5 \times 10^3$

$= 5500$

2.1: 5

In Exercises 1 - 10, find both the point-slope form and the slope-intercept form of the line with the given slope which passes through the given point.

5. $m = -\frac{1}{5}$, $P(10, 4)$ $= (x_0, y_0)$, $x_0 = 10$, $y_0 = 4$

point-slope form

$y - y_0 = m(x - x_0)$

(x_0, y_0) = fixed point on the line

m = slope of line

(x, y) = variable point on the line

$$\boxed{y - 4 = \left(-\frac{1}{5}\right)(x - 10)}$$

slope-intercept $y = mx + b$

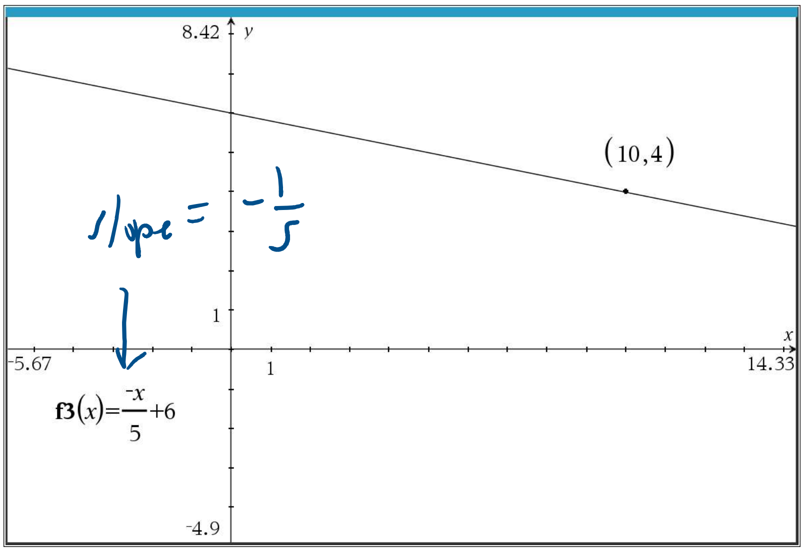
m = slope, b = y-intercept

$y = \left(-\frac{1}{5}\right)(x - 10) + 4$

$y = \left(-\frac{1}{5}\right)x + \left(\frac{1}{5}\right)(10) + 4$

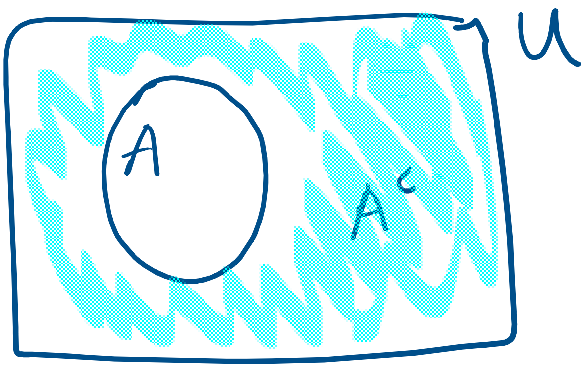
$\boxed{y = -\frac{x}{5} + 6}$ slope-intercept form

$\boxed{y = -\frac{x}{5} + 6}$ slope-intercept form



Trace with $x=10$
$\Rightarrow (10,4)$ is a point on the line

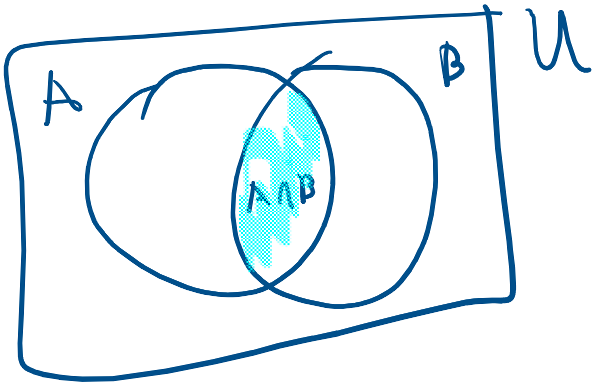
Memorize
Define A^c = complement = $\{x \in U \mid x \notin A\}$



$A \subseteq U$

$A \cap A^c = \emptyset$

$A \cup A^c = U$



$A \cap B \subseteq A$

$A \cap B \subseteq B$

$A = \{1, 3, 5, 6\}$

$B = \{2, 3, 4, 5\}$

$A \cap B = \{3, 5\}$

$A \cup B = \{1, 2, 3, 4, 5, 6\}$

Let $f(x) = \sqrt{x+4}$ domain of $f = \{x \mid x \geq -4\}$

$= [-4, \infty)$

$x + 4 \geq 0$

$x \geq -4$

Let $g(x) = -x$ domain of $g = (-\infty, \infty)$

Let $h(x) = f(x) + g(x)$

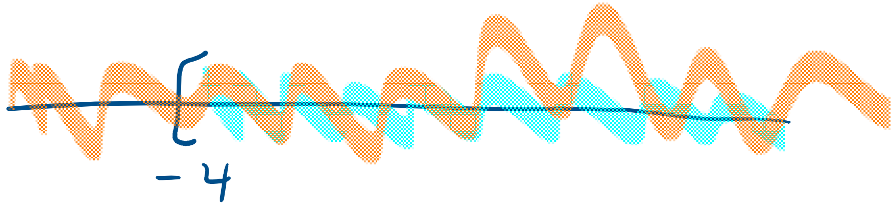
$h(x) = \sqrt{x+4} - x$

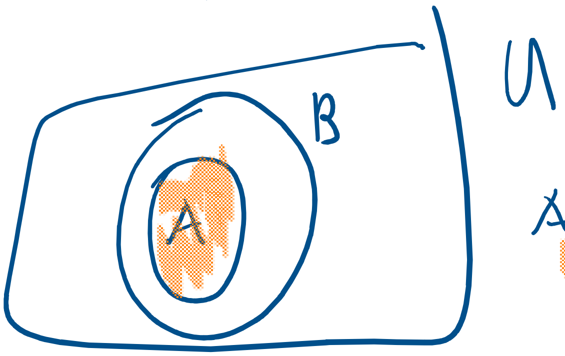
Find domain of h

$=$ (doman of f) $\cap$ (domain of g)

$= (\text{domain of } f) \cap (\text{domain of } g)$

$= [-4, \infty) \cap (-\infty, \infty) = [-4, \infty)$





$A \cap B = A$

1, 4, 35

35. Let $f(x) = \begin{cases} x+5 & \text{if} \quad x \le -3 \\ \sqrt{9-x^2} & \text{if} \quad -3 < x \le 3 \\ -x+5 & \text{if} \quad x > 3 \end{cases}$ Compute the following function values.

(a) $f(-4)$ (b) $f(-3)$ (c) $f(3)$

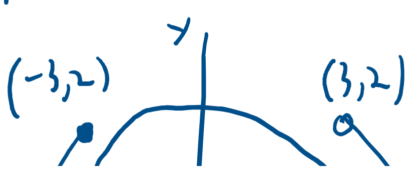
(d) $f(3.001)$ (e) $f(-3.001)$ (f) $f(2)$

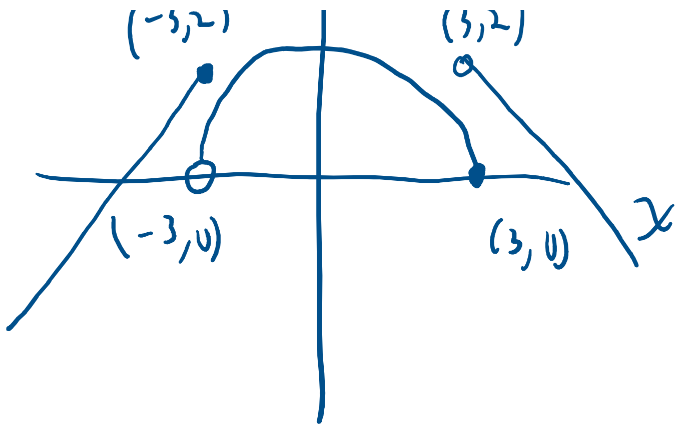
(a) $-4 \le -3 \Rightarrow f(-4) = -4+5 = \boxed{1}$

$y = \sqrt{9-x^2}$

$y^2 = 9 - x^2$

$x^2 + y^2 = 9$ circle, center $(0,0)$, radius $= 3$





1.5: 49

In Exercises 46 - 50, $C(x)$ denotes the cost to produce x items and $p(x)$ denotes the price-demand function in the given economic scenario. In each Exercise, do the following:

- Find and interpret $C(0)$.
- Find and interpret $\overline{C}(10)$.
- Find and interpret $p(5)$
- Find and simplify $R(x)$.
- Find and simplify $P(x)$.
- Solve $P(x) = 0$ and interpret.

49. The daily cost, in dollars, to produce x Sasquatch Berry Pies $C(x) = 3x + 36$, $x \geq 0$ and the price-demand function, in dollars per pie, is $p(x) = 12 - 0.5x$, $0 \leq x \leq 24$.

$$P(x) = R(x) - C(x)$$
$$= x\,p(x) - C(x)$$
$$= x(12 - 0.5x) - (3x + 36)$$
$$= -0.5x^2 + 12x - 3x - 36$$
$$\boxed{P(x) = -0.5x^2 + 9x - 36}$$

solve $-0.5x^2 + 9x - 36 = 0$

$$-\frac{x^2}{2} + 9x - 36 = 0$$
$$\left(-\frac{x^2}{2}\right)(-2) + (9x)(-2) - 36(-2) = 0(-2)$$

$$\left(-\frac{x^2}{2}\right)(-2) + (9x)(-2) - 36(-2) = 0(-2)$$

$$\boxed{x^2 - 18x + 72 = 0}$$

$$(x-12)(x-6) = 0$$

$$\boxed{x = 12, 6}$$

If 6 or 12 Pies are sold, we break-even.