Exam 1. Math 110.

Exam Guidelines This is an in-class, written exam with a 75-minute time limit.

- **Permitted Materials:** You may use a basic calculator and formula sheets.
- **Formula Sheet Restrictions:** Your sheets must contain formulas only; no examples or worked problems are permitted. All sheets will be inspected at the start of the exam.
- **Prohibited Items:** Phones and all other smart devices are strictly forbidden.
- **Academic Integrity:** The use of AI is prohibited. Any AI usage will result in an automatic F for the exam and may lead to failing the entire course.
- Show **ALL** your work for credits.

1. Graph the below line.

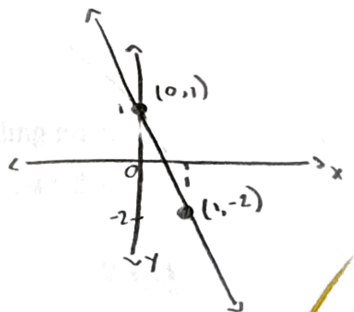
   a. $y = -3x + 1$

   $x = 0$; $y = -3(0)+1$

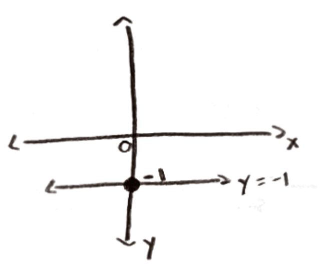
   $(0,1)$ $y = 1$

   $x = 1$; $y = -3(1)+1$

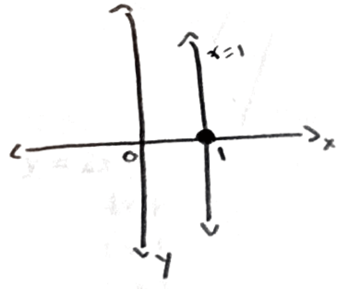
   $(1,-2)$ $y = -2$



   b. $y = -1$



   c. $x = 1$



2. Write the equation of the line

a. passing through two points (2, 2) and (0, 1)

$(2, 2) \to x_1, y_1$; $(0, 1) \to x_2, y_2$

$y = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) + y_1$

$Y = \frac{1-2}{0-2}(x-2)+2$

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

$Y = 0.5x - 1 + 2$

$\boxed{Y = 0.5x + 1}$

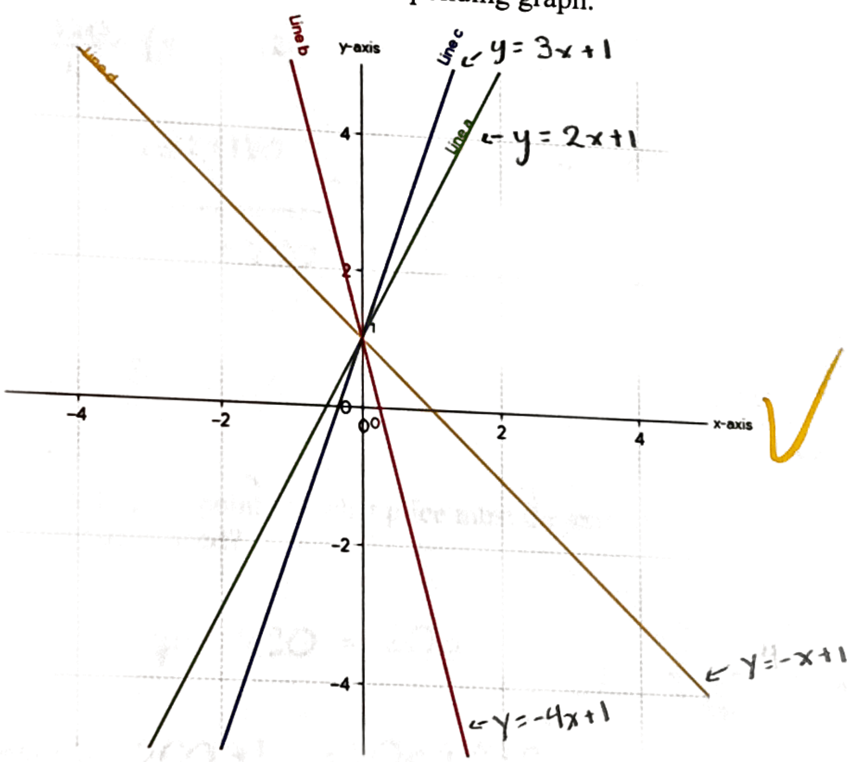
b. with the slope of 4 and passing through (1, 1) $y = m(x - x_1) + y_1$

$y = 4(x-1)+1$

$y = 4x - 4 + 1$

$\boxed{y = 4x - 3}$

3. Match each equation to its corresponding graph.



a. $y = 2x + 1$
b. $y = -4x + 1$
c. $y = 3x + 1$
d. $y = -x + 1$

4. You run a small stand at a weekend market selling fresh fruit smoothies.

Market research shows that you can sell 180 smoothies per week if the price is \$4 per smoothie, but sales decrease to 60 smoothies per week if the price is increased to \$10 per smoothie.

On the supply side, local vendors are willing to supply 50 smoothies per week when the price is \$3 per smoothie, and they will increase production to 170 smoothies per week if the price rises to \$9 per smoothie.

a. Write the linear demand function and the linear supply function.

Demand

P	Q
4	180
10	60

$$Qd = \frac{60-180}{10-4}(p-4)+180$$

$$Qd = \frac{-120}{6}(p-4)+180$$

$$Qd = -20p + 80 + 180$$

$$\boxed{Qd = -20p + 260}$$

Supply

P	Q
3	50
9	170

$$Qs = \frac{170-50}{9-3}(p-3)+50$$

$$Qs = \frac{120}{6}(p-3)+50$$

$$Qs = 20p - 60 + 50$$

$$\boxed{Qs = 20p - 10}$$

b. Find the equilibrium point. At what price must the smoothies be sold so that quantity supplied equals quantity demanded?

$$-20p + 260 = 20p - 10$$

$$260 + 10 = 20p + 20p$$

$$\frac{270}{40} = \frac{\cancel{40}p}{\cancel{40}}$$

$$\boxed{6.75 = p}$$

The smoothies should be sold at \$6.75.

5. A company that manufactures custom stainless-steel water bottles has fixed monthly costs of $90,000 and variable costs of $35 per bottle produced. Each bottle sells for $95.

a. Find the cost function.

$C = 35q + 90{,}000$

b. Find the revenue function.

$R = 95q$

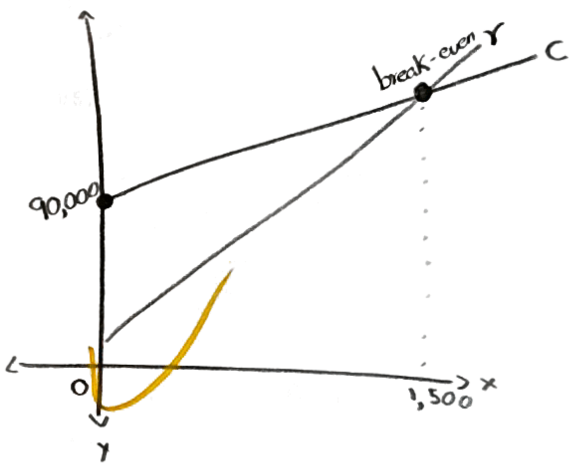
c. Graph and clearly label the cost and revenue functions on the same set of axes. Identify and label the break-even point.

$35q + 90{,}000 = 95q$

$90{,}000 = 95q - 35q$

$\frac{90{,}000}{60} = \frac{\cancel{60}q}{\cancel{60}}$

$\boxed{1{,}500 = q}$



d. Find the profit function.

$P = 95q - (35q + 90{,}000)$

$P = 95q - 35q - 90{,}000$

$\boxed{\text{Profit} = 60q - 90{,}000}$

e. How much profit will the company make by producing and selling 1,800 bottles?

$P = 60(1{,}800) - 90{,}000$

$P = 108{,}000 - 90{,}000$

$\boxed{\text{Profit} = 18{,}000}$

f. How many bottles must be produced and sold in order to obtain a profit of $60,000?

$60{,}000 = 60q - 90{,}000$

$60{,}000 + 90{,}000 = 60q$

$\frac{150{,}000}{60} = \frac{\cancel{60}q}{\cancel{60}}$

$\boxed{q = 2{,}500}$

6. Two investment options that earn simple interest are available.

Investment A starts with \$1,000 and earns simple interest at an annual rate of 5%.
Investment B starts with \$2,000 and earns simple interest at an annual rate of 2%.

a. Write a linear equation that represents the total amount of money in each investment after t years.

$A = 1{,}000 + 1{,}000(0.05)t$

$\boxed{A = 1{,}000 + 50t}$

$B = 2{,}000 + 2{,}000(0.02)t$

$\boxed{B = 2{,}000 + 40t}$

b. How much money will there be in Investment A after 4 years?

$A = 1{,}000 + 50(4)$

$\boxed{A = 1{,}200}$

c. When will Investment A reach \$1,860?

$1{,}860 = 1{,}000 + 50t$

$1{,}860 - 1{,}000 = 50t$

$\frac{860}{50} = \frac{50t}{50}$

$\boxed{t = 17.2}$

d. Determine which investment grows faster and explain your answer by comparing the slopes of the two equations.

$A = 1{,}000 + 50t \approx$ slope $m = 50$

$B = 2{,}000 + 40t \approx$ slope $m = 40$

Invesment A grows faster since it has a larger slope of 50.

e. Determine whether the two investments will ever have the same total value. If so, find when this occurs.

$$1{,}000 + 50t = 2{,}000 + 40t$$

$$50t - 40t = 2{,}000 - 1{,}000$$

$$\frac{10t}{10} = \frac{1{,}000}{10}$$

$$\boxed{t = 100}$$

f. Plot both investment functions on the same coordinate system.