Exam 1 – Practice 2

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

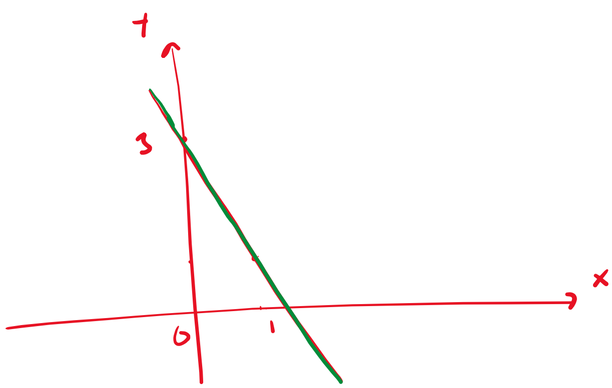
- **Permitted Materials:** You may use a basic calculator and a formula sheet.
- **Formula Sheet Restrictions:** Your sheet must contain **formulas only**; no examples or worked problems are permitted. All sheets will be inspected at the start of the exam.
- **Prohibited Items:** Phones and all other 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.

1. Graph the below line.

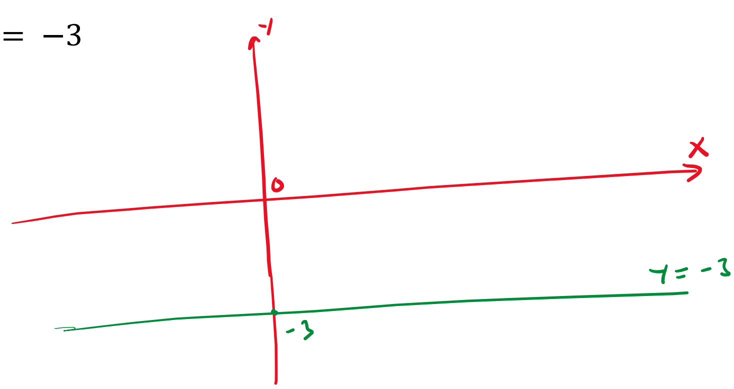
   a. $y = -2x + 3$

$x = 0,\quad y = 3 \Rightarrow (0, 3)$

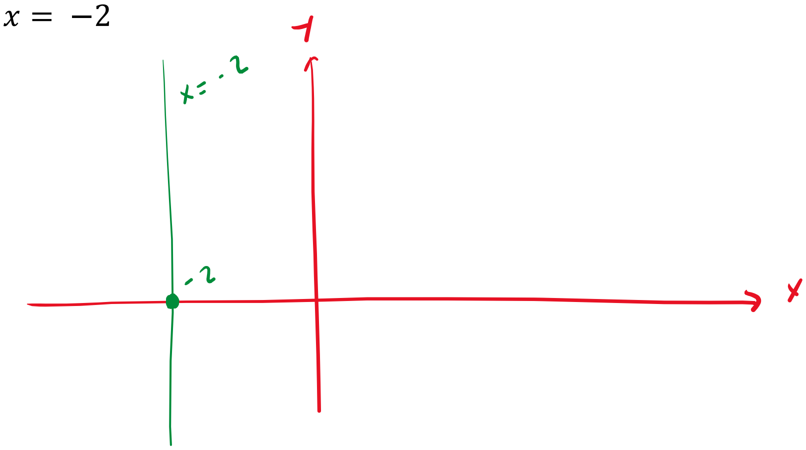
$x = 1,\quad y = 1 \Rightarrow (1, 1)$



   b. $y = -3$



c. $x = -2$



2. Write the equation of the line

a. passing through two points (1, 0) and (2, -3)

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

$$\Rightarrow \quad y = -3(x-1)$$

$$\Rightarrow \quad \boxed{y = -3x + 3}$$

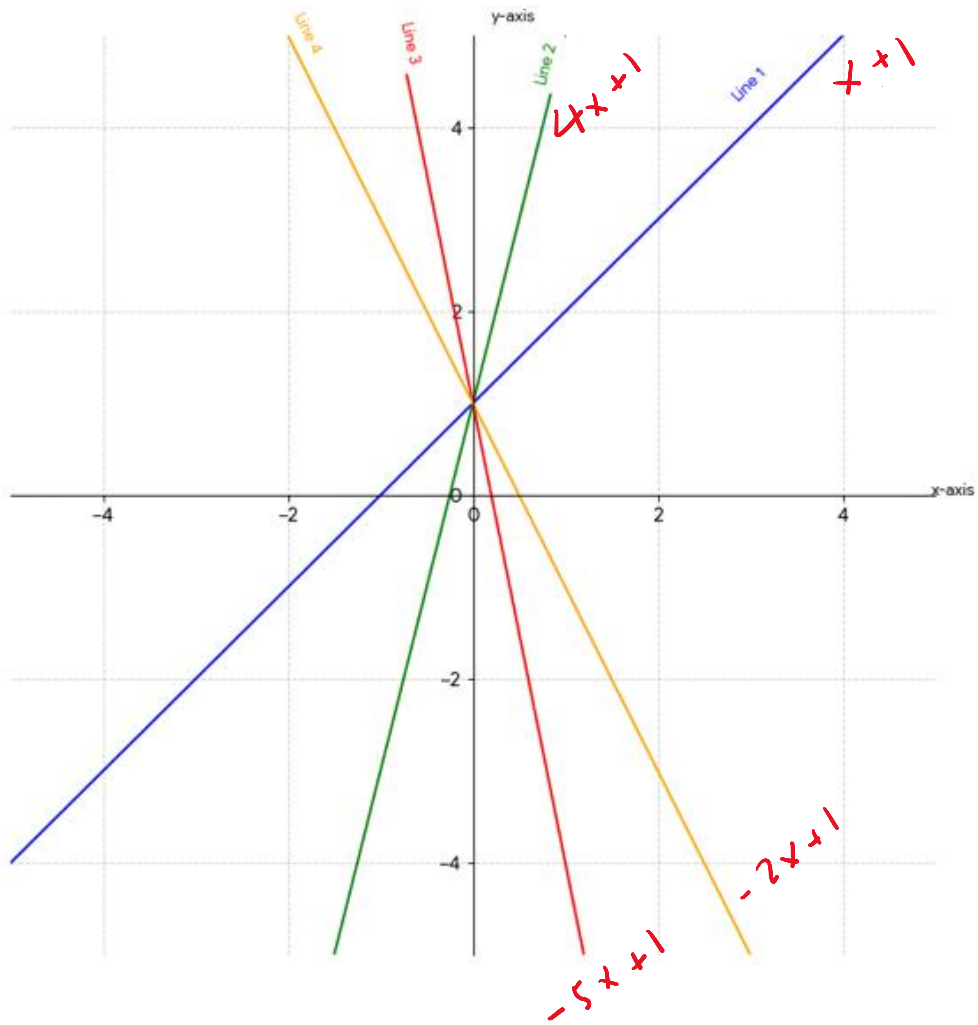
b. with the slope of 3 and passing through (1, -2)

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

$$\Rightarrow \quad y = 3x - 3 - 2$$

$$\Rightarrow \quad \boxed{y = 3x - 5}$$

3. Match each equation to its corresponding graph.



a. $y = x + 1$ line 1
b. $y = -5x + 1$ line 3
c. $y = 4x + 1$ line 2
d. $y = -2x + 1$ line 4

4. You operate a small farmers’ market stand that sells fresh organic honey.

Market research shows that you can sell 200 jars per month if the price is \$6 per jar, but sales drop to 80 jars per month if the price is raised to \$14 per jar.

On the supply side, local beekeepers are willing to supply 60 jars per month when the price is \$5 per jar, but they will increase production to 180 jars per month if the price rises to \$13 per jar.

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

Supply :

P	Q_s
6	200
14	80

$$\Rightarrow Q_s = \frac{80-200}{14-6} \cdot (P-6) + 200$$

$$Q_s = -15(P-6) + 200$$

$$Q_s = -15P + 90 + 200$$

$$\boxed{Q_s = -15P + 290}$$

Demand

P	Qd
5	60
13	180

$$\Rightarrow Q_d = \frac{180-60}{13-5} \cdot (P-5) + 60$$

$$\Rightarrow Qd = 15(P-5) + 60$$

$$\Rightarrow \quad Q_d = 15p - 75 + 60$$

$$\Rightarrow \quad \boxed{Q_d = 15p - 15}$$

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

$$Q_s = Q_d$$

$$\Rightarrow \quad -15p + 290 = 15p - 15$$

$$\Rightarrow \quad 290 + 15 = 15p + 15p$$

$$\Rightarrow \quad 305 = 30p$$

$$\Rightarrow \quad p = \frac{305}{30} \approx 10.17$$

5. A company that manufactures custom hoodies has fixed monthly costs of $75,000 and variable costs of $40 per hoodie produced. Each hoodie sells for $110.

a. Find the cost function.

$$C = 40q + 75000$$

b. Find the revenue function.

$$R = 110q$$

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

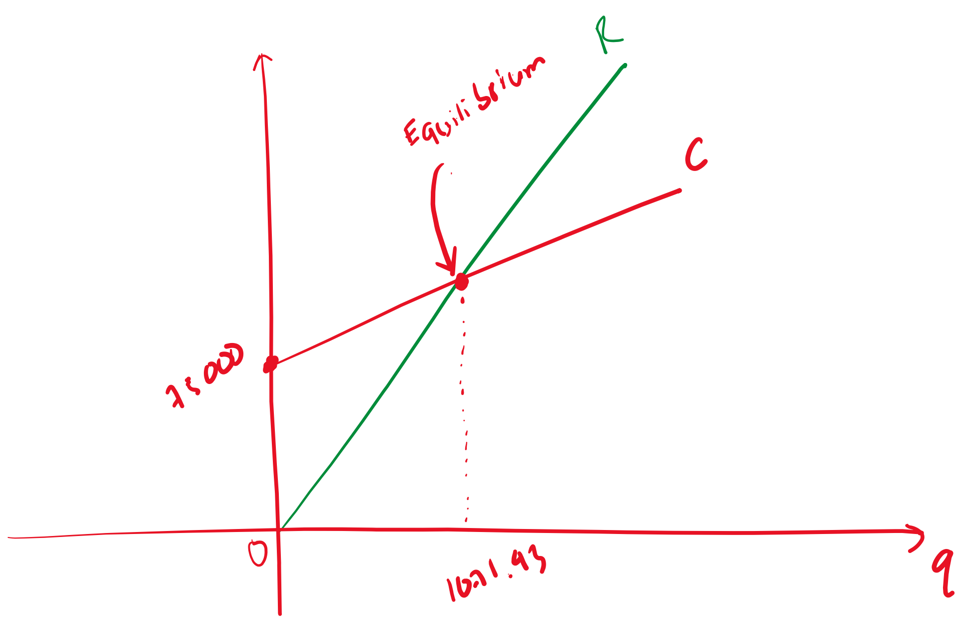
$$R = C$$

$$\Rightarrow \quad 110q = 40q + 75000$$

$$\Rightarrow \quad 110q - 40q = 75000$$

$$\Rightarrow \quad 70q = 75000$$

$$\Rightarrow \quad q \simeq 1071.43$$



d. Find the profit function.

$$\text{Profit} = 110q - (40q + 75000)$$

$$= 110q - 40q - 75000$$

$$= \boxed{70q - 75000}$$

e. How much profit will the company make by producing and selling 2,000 hoodies?

$q = 2000$

$$\Rightarrow \quad \text{Profit} = 70 \times 2000 - 75000$$

$$= 65000$$

f. How many hoodies must be produced and sold in order to obtain a profit of $75,000?

$$75000 = 70q - 75000$$

$$\Rightarrow \quad 75000 + 75000 = 70q$$

$$\Rightarrow \quad 150000 = 70q$$

$$\Rightarrow \quad q = \frac{150000}{70} \approx 2142.86$$

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

Investment A starts with **$1,500** and earns **simple interest at an annual rate of 3%**.
Investment B starts with **$2,400** and earns **simple interest at an annual rate of 1.5%**.

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

$A = 1500 + 1500 \times .03\, t$

$A = 1500 + 45t$

Investment B :

$B = 2400 + 2400 \times .015\, t$

$B = 2400 + 36t$

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

$t = 4$

$\Rightarrow A = 1500 + 45t$

$= 1500 + 45 \times 4$

$= 1680$

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

$A = 1860$

$$\Rightarrow \quad 1500 + 45t = 1860$$

$$\Rightarrow \quad 45t = 1860 - 1500$$

$$\Rightarrow \quad 45t = 360$$

$$\Rightarrow \quad t = \frac{360}{45} = 8$$

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

$$A = 1500 + 45t \quad (\text{slope} = 45)$$

$$B = 2400 + 36t \quad (\text{slope} = 36)$$

$\Rightarrow$ A grows faster due to greater slope

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

$$A = B$$

$$\Rightarrow \quad 1500 + 45t = 2400 + 36t$$

$$36t = 2400 - 1500$$

$\Rightarrow \quad 45t \; -$

$\Rightarrow \quad 9t = 900$

$\Rightarrow \quad t = 100$

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