APPLICATIONS OF LINEAR SYSTEMS

1. After ticket sales at a volleyball game, a cash box contains 87 coins in loonies and toonies. If the total value of the money is \$161, how many of each kind of coin is there? The situation can be represented by the following system of equations:

① $l + t = 87$
② $l + 2t = 161$

where l represents the number of **loonies** and t represents the number of **toonies**.

a) Solve the system of equations by substitution OR elimination. both variables on left side of equal sign

$l + t = 87$
$-(l + 2t = 161)$
$\varnothing\ [t - 2t] = [87 - 161]$
$-t = -74$
$\frac{-t}{-1} = \frac{-74}{-1}$
$t = 74$

Sub $t = 74$ into ①
$l + t = 87$
$l + (74) = 87$
$l = 87 - 74$
$l = 13$

∴ POI is $(13, 74)$ (l, t)

b) How many loonies are in the cash box?

∴ There are 13 loonies

c) How many toonies are in the cash box?

∴ There are 74 toonies

2. A bank teller has a total of 124 bills in fives and tens. The total value of the money is \$840. The equations represent this situation.

Total number of bills: $x + y = 124$ ①
Total value: $5x + 10y = 840$ ②

where x represents the number of \$5 bills and y represents the number of \$10 bills.

① × 5 $5(x + y = 124)$
$5x + 5y = 620$ ③

a) Solve the system of equations by substitution OR elimination. both variables are on the left side

② & ③
$5x + 10y = 840$
$-(5x + 5y = 620)$
$\varnothing\ [10y - 5y] = [840 - 620]$
$\frac{5y}{5} = \frac{220}{5}$
$y = 44$

Sub $y = 44$ into ①
$x + y = 124$
$x + (44) = 124$
$x = 124 - 44$
$x = 80$

∴ POI is $(80, 44)$ (\$5, \$10)

b) How many \$5 bills does the bank teller have?

∴ There are 80 \$5 bills

c) How many \$10 bills does the bank teller have?

∴ There are 44 \$10 bills

3. At a sale, each DVD is one price and each CD is another price. Three DVDs and two CDs cost $67. One DVD and three CDs cost $48. This situation can be described by a linear system:

$3d + 2c = 67$ ①
$d + 3c = 48$ ②

② × 3 → $3(d + 3c = 48)$
$3d + 9c = 144$ ③

where d represents the price of a DVD in dollars and c represents the price of a CD in dollars.

a) Solve the linear system by substitution OR elimination.

① & ③

$3d + 2c = 67$
$-3d + 9c = 144$

$[2c - 9c] = [67 - 144]$

$-7c = -77$

$\frac{-7c}{-7} = \frac{-77}{-7}$

$c = 11$

Sub $c = 11$ into ②

$d + 3c = 48$

$d + 3(11) = 48$

$d + 33 = 48$

$d = 48 - 33$

$d = 15$

b) How much does one DVD cost?

∴ A dvd costs $15

c) How much does one CD cost?

∴ A CD costs $11

4. An airplane travels at an average speed of 740 km/h with a tail wind and 560 km/h with a head wind. This situation can be described by a linear system:

$s + w = 740$ ⇝ $s = -w + 740$
$s - w = 560$ ⇝ $s = w + 560$

where s is the speed of the plane with no wind in km/h and w is the wind speed in km/h.

a) Solve the linear system by substitution OR elimination. → both variables are on left side
↳ can rearrange both equations into s=

$-w + 740 = w + 560$

$-w - w = 560 - 740$

$-2w = -180$

$\frac{-2w}{-2} = \frac{-180}{-2}$

$w = 90$

Sub $w = 90$ into ①

$s + w = 740$

$s + (90) = 740$

$s = 740 - 90$

$s = 650$

b) Explain what the solution to the linear system represents.

With no wind, the plane would travel 650 km/h

c) What is the wind speed?

90 km/h