Applications of Linear Systems

1. Let x be the cost of one CD.
Let y " " " " " tape.

$3x + 2y = 72$ (A)
$x + 3y = 52$ (B)

$3x + 2y = 72$ (A)
$3x + 9y = 156$ (B) $\times 3$

$-7y = -84$

$y = \frac{-84}{-7}$

$y = 12$

Sub $y = 12$ into (B)
$x + 3y = 52$
$x + 3(12) = 52$
$x + 36 = 52$
$x = 52 - 36$
$x = 16$

Check $(\overset{x}{16}, \overset{y}{12})$

... in (A)

$LS = 3x + 2y$ $\quad RS = 72$
$= 3(16) + 2(12)$
$= 48 + 24$
$= 72$

$LS. = RS.$

...in (B)

$LS = x + 3y$ $\quad RS = 52$
$= 16 + 3(12)$
$= 16 + 36$
$= 52$

$LS = RS.$

$\therefore$ the cost of one CD is \$16 and
the cost of one tape is \$12.

2.

Let x be the initiation fee in dollars.
Let y " " monthly fee in dollars.

$x + 5y = 170$ (A)
$x + 10y = 295$ (B)

(−) $-5y = -125$

$y = \frac{-125}{-5}$

$y = 25$

Sub $y = 25$ into (A)

$x + 5y = 170$
$x + 5(25) = 170$
$x = 170 - 125$
$x = 45$

Check $(\overset{x}{145}, \overset{y}{25})$

... in (A)

LS $= x + 5y$ RS $= 170$
$= 45 + 5(25)$
$= 45 + 125$
$= 170$

... in (B)

LS $= x + 10y$ RS $= 295$
$= 45 + 10(25)$
$= 45 + 250$
$= 295$

$\therefore$, the initiation fee is \$45.

(3) Let x be the annual fee.
Let y be the hourly fee.

$x + 39y = 384$ (A)
$x + 51y = 456$ (B)

(−) $-12y = -72$

$y = \frac{-72}{-12}$

$y = 6$

Sub $y = 6$ into (A)

$x + 39y = 384$
$x + 39(6) = 384$
$x + 234 = 384$
$x = 384 - 234$
$x = 150$

Check $(\overset{x}{150}, \overset{y}{6})$

... in (A)

LS $= x + 39y$
$= (150) + 39(6)$
$= 150 + 234$
$= 384$

RS $= 384$

LS = RS

... in (B)

LS $= x + 51y$
$= 150 + 51(6)$
$= 150 + 306$
$= 456$

RS $= 456$

LS = RS.

∴, the annual fee is $\$150$ and the hourly fee is $\$6$.

(4.) Let x be the cost of one football.

Let y " " " " one soccer ball.

$3x + y = 155$ (A)

$2x + 3y = 220$ (B)

$9x + 3y = 465$ (A) $\times 3$

$2x + 3y = 220$ (B)

$(-)\quad 7x = 245$

$x = \frac{245}{7}$

$x = 35$

Sub $x = 35$ into (A)

$3x + y = 155$

$3(35) + y = 155$

$105 + y = 155$

$y = 155 - 105$

$y = 50$

Check $(\overset{x}{35}, \overset{y}{50})$

...in (A)

LS $= 3x + y$ RS $= 155$

$= 3(35) + 50$

$= 155$

LS = RS

...in (B)

LS $= 2x + 3y$ RS $= 220$

$= 2(35) + 3(50)$

$= 70 + 150$

$= 220$

LS = RS.

∴, the cost of one football is $35 and the cost of one soccer ball is $50.

⑤ Let x be the number of student tickets sold.
Let y be the " " adult tickets sold.

$x = 2y$ (A)

$3x + 5y = 1650$ (B)

- "y" adult tickets sold.
- student tickets sold twice as many as adult tickets
- So...

$x = 2y$

↑ student tickets sold ↑ adult tickets sold

Sub $x = 2y$ into (B)

$3x + 5y = 1650$

$3(2y) + 5y = 1650$

$6y + 5y = 1650$

$11y = 1650$

$y = \frac{1650}{11}$

$y = 150$

Sub $y = 150$ into (A)

$x = 2y$

$x = 2(150)$

$x = 300$

Check $(\overset{x}{300}, \overset{y}{150})$

... in (A)

LS $= x$
$= 300$

RS $= 2y$
$= 2(150)$
$= 300$

LS = RS

... in (B)

LS $= 3x + 5y$
$= 3(300) + 5(150)$
$= 900 + 750$
$= 1650$

RS $= 1650$

LS = RS.

∴, 300 student tickets were sold and 150 adult tickets were sold.

(6). Let x be the cost of a seat between the goal lines.

Let y be the cost of a seat in the end zones.

$$y = x - 5 \quad (A)$$

$$20000x + 5000y = 350000 \quad (B)$$

Sub $y = x - 5$ into (B)

$$20000x + 5000y = 350000$$

$$20000x + 5000(x-5) = 350000$$

$$20000x + 5000x - 25000 = 350000$$

$$25000x = 350000 + 25000$$

$$25000x = 375000$$

$$x = \frac{375000}{25000}$$

$$x = 15$$

Sub $x = 15$ into (A)

$$y = x - 5$$

$$y = 15 - 5$$

$$y = 10$$

Check $(\overset{x}{15}, \overset{y}{10})$

...in (A)

L.S. $= y$
$= 10$

R.S. $= x - 5$
$= 15 - 5$
$= 5$

L.S. = R.S.

...in (B)

L.S. $= 20000x + 5000y$
$= 20000(15) + 5000(10)$
$= 350000$

R.S. $= 350000$

L.S. = R.S.

∴, a seat between the goal lines costs $15 and a seat in the end zones costs $10.

(7) Let x be the mass of the box.
Let y be the " " a bolt.

$x + 20y = 340$ (A)
$x + 48y = 760$ (B)

(−) $-28y = -420$

$y = \frac{-420}{-28}$

$y = 15$

Sub $y = 15$ in (A)

$x + 20y = 340$
$x + 20(15) = 340$
$x + 300 = 340$
$x = 340 - 300$
$x = 40$

Check $(40, 15)$

... in (A)

L.S. $= x + 20y$ R.S. $= 340$
$= 40 + 20(15)$
$= 40 + 300$
$= 340$

L.S. = R.S.

... in (B)

L.S. $= x + 48y$ R.S. $= 760$
$= 40 + 48(15)$
$= 40 + 720$
$= 760$

L.S. = R.S.

∴, the box has a mass of 40g and each bolt has a mass of 15g.

(8) Let x be the mass of the crate.
Let y " " " " one grapefruit.

$$x + 36y = 4 \quad (A)$$
$$x + 24y = 3 \quad (B)$$

(36 − 12)

$$12y = 1$$
$$y = \frac{1}{12}$$

Sub $y = \frac{1}{12}$ into (B)

$$x + 24y = 3$$
$$x + 24\left(\frac{1}{12}\right) = 3$$
$$x + 2 = 3$$
$$x = 3 - 2$$
$$x = 1$$

Check $(\overset{x}{1}, \overset{y}{\frac{1}{12}})$

... in (A)

$LS = x + 36y$ $\quad RS = 4$
$= 1 + 36\left(\frac{1}{12}\right)$
$= 1 + 3$
$= 4$

$LS = RS$

... in (B)

$LS = x + 24y$ $\quad RS = 3$
$= 1 + 24\left(\frac{1}{12}\right)$
$= 1 + 2$
$= 3$

$LS = RS$

∴, the mass of the crate is 1 kg and the mass of one grapefruit is $\frac{1}{12}$ kg or about 0.083 kg.