



**NUTRITION :** Orange trees thrive in warm, Mediterranean climates where there is no threat of frost. This full-sun plant produces the best fruit when provided with optimal moisture, light and nutrition, in the form of fertilization. Orange trees require fertilization three times per year. You need to increase fertilizer amounts as the tree ages and becomes established. Complete nutrition is essential for a healthy tree.



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A fruit grower can use two types of fertilizer in an orange grove, brand A and brand B. Each bag of brand A contains 8 pounds of nitrogen and 4 pounds of phosphoric acid. Each bag of brand B contains 7 pounds of nitrogen and 7 pounds of phosphoric acid. Tests indicate that the grove needs 720 pounds of nitrogen and 500 pounds of phosphoric acid.

- (i) How many bags of brand A should be used to provide the required amounts of nitrogen and phosphoric acid?
- (ii) How many bags of brand B should be used to provide the required amounts of nitrogen and phosphoric acid?

Sol :

Let  $a$  represent requirement of bag of brand A and  $b$  represent requirement of bag of brand B.

Each bag of brand A contains 8 pounds of nitrogen and 4 pounds of phosphoric acid. Each bag of brand B contains 7 pounds of nitrogen and 7 pounds of phosphoric acid.

We summarized production in following table.

	Brand A	Brand B	Requirement
Nitrogen	$8a$	$7b$	720
Phosphoric acid	$4a$	$7b$	500

(i) Since grove needs 720 pounds of nitrogen, we have

$$8a + 7b = 720 \quad (1)$$

Since grove needs 500 pounds of phosphoric acid, we have

$$4a + 7b = 500 \quad (2)$$

Subtracting eq (2) from eq (1) we have

$$4a = 220 \Rightarrow a = 55$$

Thus 55 bags of brand A is required.

(ii) Multiplying eq (2) by 2 we have

$$8a + 14b = 1000 \quad (3)$$

Subtracting eq (1) from eq (iii) we have

$$7b = 280 \Rightarrow b = \frac{280}{7} = 40$$

Thus 40 bags of brand B is required.

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Hostel Life : Banasthali Vidyapith, is a fully residential women's university offering courses from primary to Ph.D. level. It offers a number of UG, PG, and Doctoral level Programs under various Departments. Admission to the same is done on the basis of merit scored in qualifying examination, however, for some courses, an aptitude test is also conducted at the university level.



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Swati is doing MSc. in biotechnology from Banastli Vidyapith and lives in university hostel. A part of monthly hostel charge is fixed and the remaining depends on the number of days one has taken food in the mess. When Swati takes food for 18 days, she has to pay Rs. 5160 as hostel charges whereas Taniya who takes food for 23 days Rs. 5760 as hostel charges.

- (i) Find the fixed charges of hostel.
- (ii) Find the cost of food per day.

Sol :

Let fixed charge be  $x$  and per day food cost be  $y$ .

$$x + 18y = 5160 \quad \dots(1)$$

$$x + 23y = 5760 \quad \dots(2)$$

Subtracting (1) from (2) we have

$$5y = 600 \Rightarrow y = 120$$

Substituting this value of  $y$  in (1), we get

$$x + 18 \times 120 = 5160$$

$$x = 5160 - 2160 = 3000$$

Thus  $x = 3000$  and  $y = 120$

- (i) Fixed charges of hostel is Rs 3000.
- (ii) Cost of food per day is Rs 120.

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Architectural Wonders : When it was first constructed in 1889, the Eiffel Tower in Paris, France, was the tallest structure in the world. In 1975, the CN Tower in Toronto, Canada, became the world's tallest structure. The CN Tower is 153 ft less than twice the height of the Eiffel Tower, and the sum of their heights is 2799 ft.



4. (i) How tall is CN tower?  
(ii) How tall is Eiffel tower?

Sol :

Let the heights of Eiffel tower and CN tower be  $x$  and  $y$  respectively.

The CN Tower is 153 ft less than twice the height of the Eiffel Tower, thus

$$2x - y = 153 \quad \dots(1)$$

The sum of their heights is 2799 ft, thus

$$x + y = 2799 \quad \dots(2)$$

Adding eqn, (1) and (2), we get

$$3x = 2952 \Rightarrow x = 984$$

Substituting  $x = 984$  in eq (2), we get

$$y = 2799 - 984 = 1815$$

- (i) The height of CN tower is 1815 ft.  
(ii) The height of Eiffel tower is 984 ft.

5.

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**Airport Walkways :** A moving walkway, also known as an autowalk, is a slow-moving conveyor mechanism that transports people across a horizontal or inclined plane over a short to medium distance. Moving walkways can be used by standing or walking on them. They are often installed in pairs, one for each direction.



As part of an algebra field trip, Jenish takes his class to the airport to use their moving walkways for a demonstration. The class measures the longest walkway, which turns out to be 256 ft long. Using a stop watch, Jenish shows it takes him just 32 sec to complete the walk going in the same direction as the walkway. Walking in a direction opposite the walkway, it takes him 320 sec (10 times as long!). The next day in class, Jenish hands out a two question quiz:

- (i) What is my (Jenish's) normal walking speed?
- (ii) What was the speed of the walkway in feet per second?

Sol :

Let  $w$  represent the speed of the walkway and  $j$  represent Jenish's walking speed.

(i) In the direction of walkway,

$$\begin{aligned}32(j + w) &= 256 \\ j + w &= 8\end{aligned}\tag{1}$$

Opposite direction of walkway,

$$\begin{aligned}320(j - w) &= 256 \\ 10j - 10w &= 8\end{aligned}\tag{2}$$

Multiplying eq (1) with 10 we have

$$10j + 10w = 80\tag{3}$$

Adding eq (2) and (3) we have

$$20j = 88 \Rightarrow j = \frac{88}{20} = 4.4 \text{ ft/sec}$$

(ii) Substituting above value of  $j$  in (1) we have

$$\begin{aligned}4.4 + w &= 8 \\ w &= 8 - 4.4 = 3.6 \text{ ft/sec}\end{aligned}$$

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