

Rate

Definition of Rate

Rate is a ratio that compares two quantities of different units.

Examples of Rate

20 oz of juice for \$4, miles per hour, cost per pound etc. are examples of rate.

More about Rate

Unit rate: Unit rate is a rate in which the second term is 1.

For example, Jake types 10 words in 5 seconds.

Jake's unit rate is the number of words he can type in a second.

His unit rate is 2 words per second.

Solved Example on Rate

"4 lb of meat costs \$5." Identify the two rates given by the statement.

Choices:

A. $\frac{4\text{ lb}}{\$5}$ and $\frac{\$5}{4\text{ lb}}$

B. $\frac{1\text{ lb}}{4\text{ lb}}$ and $\frac{5\text{ lb}}{\$4}$

C. $\frac{\$4}{5\text{ lb}}$ and $\frac{5\text{ lb}}{\$4}$

D. none of these

Correct Answer: A

Solution:

Step 1: Rate is a ratio that compares two quantities of different units.

Step 2: The two rates given by the statement are $\frac{\$4}{5\text{ lb}}$ and $\frac{5\text{ lb}}{\$4}$.

Related Terms for Rate

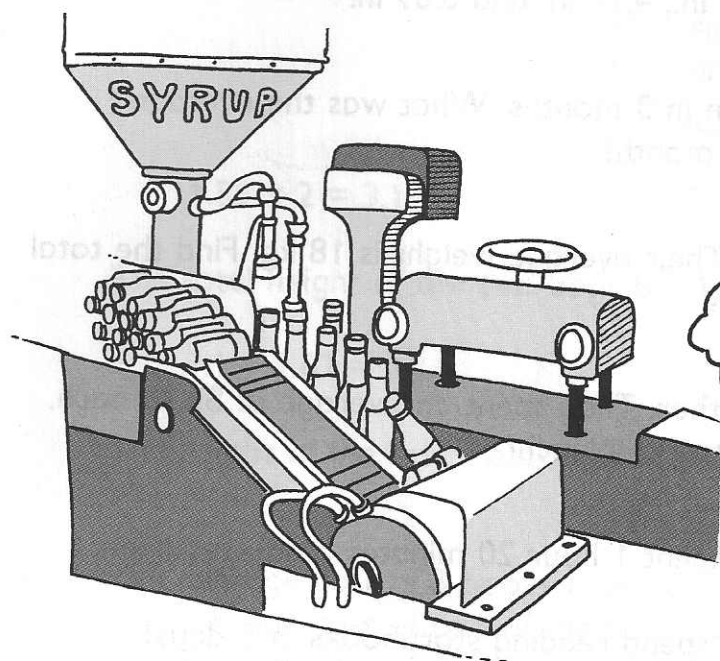
Ratio

Unit Rate

4 Rate

1 Rate

A machine fills 60 bottles of syrup in 5 minutes. How many bottles of syrup can it fill in one minute?



Assumption!

The machine fills the same number of bottles every minute.

In 5 minutes, the machine fills 60 bottles.
In 1 minute, it fills bottles.

12

$$60 \div 5 = 12$$

The machine fills the bottles at the **rate** of 12 bottles per minute. It means the machine fills 12 bottles every minute.

1. Robert is paid \$20 for working 4 hours. How much is he paid per $\frac{\$}{\text{hour}}$ hour?

$$\frac{\$}{\text{hour}} \quad 20 \div 4 = 5 \frac{\$}{\text{hour}}$$

The rate is \$5 per hour.

He is paid \$5 per hour.



2. Water is flowing from a tap at the rate of 100 liters every 4 minutes. Find the rate of flow of water in liters per minute.

$$\frac{\text{liters}}{\text{min}} \quad 100 \div 4 = \blacksquare 25 \frac{\text{liters}}{\text{min}}$$

100 l in 4 min
 \blacksquare l in 1 min

The rate of flow of water is \blacksquare l per minute.
25



Workbook Exercise 31

3. A machine makes toy cars at the rate of 120 per minute. How many toy cars will it make in 6 minutes?

$$\frac{\text{toy cars}}{\text{min}} \times \frac{\text{min}}{1} = \text{toy cars} \quad 120 \times 6 = \blacksquare \text{ toy cars}$$

120 toy cars in 1 min
 \blacksquare toy cars in 6 min

It will make \blacksquare toy cars in 6 minutes.
720



4. A lamp can flash 5 times per minute. At this rate, how many times can it flash in 30 minutes?

$$\frac{\text{times}}{\text{min}} \times \frac{\text{min}}{1} = \text{times} \quad 5 \times 30 = \blacksquare 150 \text{ times}$$

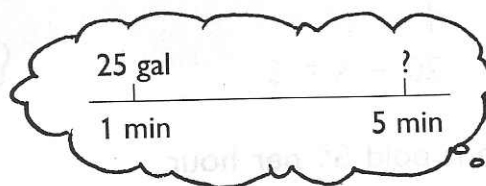
5 times in 1 min
 \blacksquare times in 30 min

The lamp can flash \blacksquare times in 30 minutes.
150



Workbook Exercise 32

5. Water is flowing from a tap at the rate of 25 gal per minute.
 (a) How much water can be collected from the tap in 5 minutes?



$$1 \text{ min} \longrightarrow 25 \text{ gal/min}$$

$$5 \text{ min} \longrightarrow 25 \times 5 = \boxed{125} \text{ gal}$$

$\frac{25 \text{ gal}}{1 \text{ min}} \times \frac{5 \text{ min}}{1} = 125 \text{ gal}$

$\boxed{125}$ gal of water can be collected from the tap in 5 minutes.



- (b) How long will it take to fill a container of capacity 100 gal?

method 2:

$$\frac{25 \text{ gal}}{\text{min}} \times x \text{ min} = 100 \text{ gal}$$

$$x \text{ min} = \frac{100 \text{ gal}}{25 \text{ gal/min}}$$

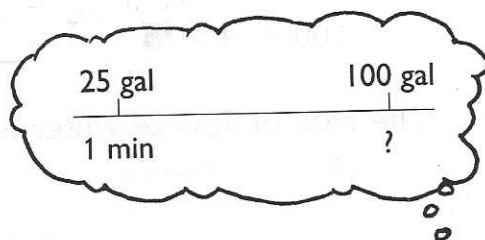
$$x \text{ min} = 4 \text{ min}$$

method 1:

$$25 \text{ gal} \longrightarrow 1 \text{ min}$$

$$1 \text{ gal} \longrightarrow \frac{1}{25} \text{ min}$$

$$100 \text{ gal} \longrightarrow \frac{1}{25} \times 100 = \boxed{4} \text{ min}$$



It will take $\boxed{4}$ minutes to fill the container.

4



6. Mrs. Ricci types 45 words per minute. At this rate, how long will she take to type 135 words?

method 2:

$$\frac{45 \text{ w}}{\text{min}} \times x \text{ min} = 135 \text{ words}$$

$$x \text{ min} = \frac{135 \text{ words}}{45 \text{ words/min}}$$

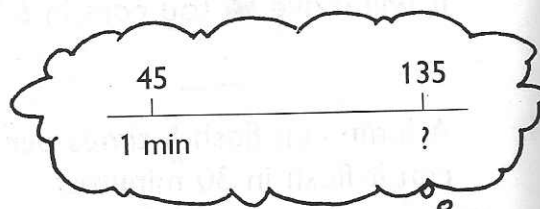
$$x \text{ min} = 3 \text{ min}$$

method 1:

$$45 \longrightarrow 1 \text{ min}$$

$$1 \longrightarrow \frac{1}{45} \text{ min}$$

$$135 \longrightarrow \frac{1}{45} \times 135 = \boxed{3} \text{ min}$$



She will take $\boxed{3}$ minutes to type 135 words.

3



es?

7. A car can travel 96 km on 8 liters of gas.
The rate is 12 km per liter.

$$\frac{96 \text{ km}}{8 \text{ liter}} = 12 \frac{\text{km}}{\text{l}}$$

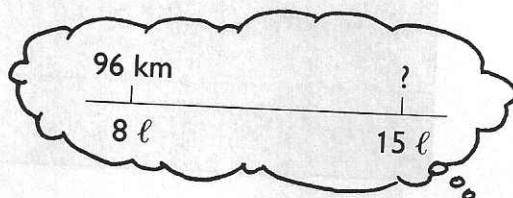
- (a) How far can the car travel on 15 liters of gas?

$$8 \text{ l} \longrightarrow 96 \text{ km}$$

$$1 \text{ l} \longrightarrow \frac{96}{8} = 12 \text{ km}$$

$$15 \text{ l} \longrightarrow 12 \times 15 = 180 \text{ km}$$

The car can travel 180 km on 15 l of gas.



- (b) How much gas will be used if the car travels a distance of 120 km?

method 2:

$$\begin{aligned} \text{rate} &= 12 \frac{\text{km}}{\text{l}} \\ 12 \frac{\text{km}}{\text{l}} \times ? \text{ l} &= 120 \text{ km} \\ ? &= \frac{120 \text{ km}}{12 \frac{\text{km}}{\text{l}}} \\ ? &= 10 \text{ l} \end{aligned}$$

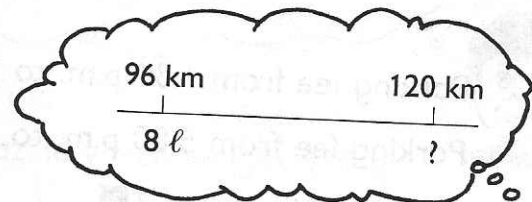
method 1:

$$96 \text{ km} \longrightarrow 8 \text{ l}$$

$$1 \text{ km} \longrightarrow \frac{8}{96} \text{ l}$$

$$120 \text{ km} \longrightarrow \frac{8}{96} \times 120 = 10 \text{ l}$$

10 l of gas will be used.



8. A photocopier can print 12 copies in 48 seconds. At this rate, how many copies can it print in 1 minute?

method 2:

$$\begin{aligned} \frac{12 \text{ copies}}{48 \text{ sec}} \times 60 \text{ sec} &= x \\ \frac{60}{48} = x \\ \frac{60}{4} = x \\ 15 = x \end{aligned}$$

method 1:

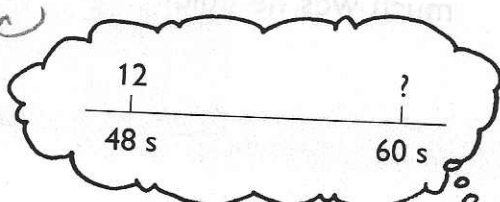
$$48 \text{ s} \longrightarrow 12 \text{ copies}$$

$$1 \text{ s} \longrightarrow \frac{12}{48}$$

$$60 \text{ s} \longrightarrow \frac{12}{48} \times 60 = 15 \text{ copies}$$

It can print 15 copies in 1 minute.

60 sec



9. The table shows the rates of charges at a parking lot.

8:00 a.m. to 5:00 p.m.	\$1 per $\frac{1}{2}$ hour
After 5:00 p.m.	\$1 per hour

$3\frac{1}{2}$ hours

2 hours

Mr. Karlson parked his car there from 1:30 p.m. to 7:00 p.m.
How much did he have to pay?

The duration from 1:30 p.m.
to 5:00 p.m. is $3\frac{1}{2}$ h.

Parking fee from 1:30 p.m. to 5:00 p.m. = \$7 ($3\frac{1}{2}$ hours)

Parking fee from 5:00 p.m. to 7:00 p.m. = \$2 (2 hours)

Total parking fee = \$■ 9



10. The workers in a factory are paid the following rates.

Weekdays	\$28 per day
Saturdays and Sundays	\$38 per day

3 days

2 days

Mr. Henderson worked from Friday to the following Tuesday. How much was he paid?

Fri/Sat/Sun/Mon/Tue

Mr. Henderson worked for 5 days.



Mr. Henderson's pay for 3 weekdays = $\$28 \times 3 = \$\blacksquare 84$

Mr. Henderson's pay for Saturday and Sunday = $\$38 \times 2 = \$\blacksquare 76$

Total pay = \$■ 160

11. The table shows the postage rates for sending magazines to another state.

Weight step not over	Postage
20 g	\$0.30
50 g	\$0.40
100 g	\$0.70
Per additional step of 100 g	\$0.60

- (a) Find the postage for a magazine which weighs 85 g.

85 g is more than 50 g but less than 100 g.

Postage for 85 g = \$ 0.70

- (b) Find the postage for a magazine which weighs 330 g.

330 g is 230 g more than 100 g.

Postage for the 1st 100 g = \$0.70

Postage for the next 230 g = $\$0.60 \times 3 = \1.80

Total postage = \$ 2.50

12. In a city, the rates of charges for taxi fare are as follows:

For the first km	\$2.40
For every additional km	\$0.40

Find the taxi fare for a trip of $5\frac{1}{2}$ km. $= 1^{\text{st}} \text{ km} + 4\frac{1}{2} \text{ km}$

Fare for the 1st km = \$2.40

Fare for the next $4\frac{1}{2}$ km = $\$0.40 \times 5 = \2.00

Total fare = \$ 4.40

PRACTICE 4A

1. A machine can print 50 pages per minute. At this rate, how long will it take to print 2500 pages?
2. A machine takes 4 minutes to seal 16 cookie boxes. How many cookie boxes can it seal in 1 minute?
3. Maggie's heart beats at the rate of 152 times every 2 minutes. At this rate, how many times does it beat in 30 minutes?
4. A pool is filled with water at the rate of 100 gal every 5 minutes. How long will it take to fill the pool with 1000 gal of water?
5. The cost of cementing 30 m² of floor area is \$810. How much will it cost to cement 55 m² of floor area?
6. A wheel covers a distance of 40 m when it makes 25 revolutions. At this rate, what distance will it cover when it makes 50 revolutions?
7. The table shows the postage rates for letters for delivery in Singapore. Find the postage for a letter which weighs
 - (a) 55 g
 - (b) 400 g

Weight step not over	Postage
20 g	\$0.22
50 g	\$0.30
100 g	\$0.50
250 g	\$0.80
500 g	\$1.50

8. The rental rates of a ski chalet are as follows:

Weekdays	\$60 per day
Saturdays and Sundays	\$80 per day

- (a) Warner rented the chalet from Friday to Sunday. How much rent did he pay?
- (b) A group of friends rented 2 chalets from Wednesday to Saturday. How much did they pay altogether?