

Rational Word Problems: Average Cost & Work

Average Cost Examples:

You have been selected to order the sophomore class shirts for Liberty. There are two different companies from which to choose. Terrific Ts charges a \$100 design fee to put your T-shirt design in the computer. They then charge \$6 per shirt ordered.

- A. Write an equation to represent the Cost of the shirts, C, in terms of the number t-shirts ordered, t.

$$C = 100 + 6t$$

- B. What would it cost to purchase 1 t-shirt?

$$\$106$$

- C. What is the cost per t-shirt if you buy:

a. 5 shirts? \$130

10 shirts? \$160

100 shirts? \$100

- D. Write an equation to find the Cost per t-shirt, C, if you buy t t-shirts.

$$C = \frac{100 + 6t}{t}$$

- E. What is the domain? (ie the possible number of shirts you can buy)

$$[1, \infty)$$

Lots one shirt

- F. What is the range? (ie the lowest and highest possible cost per t-shirt)

$$(6, 106]$$

- G. Why is there a limit to the lowest possible cost per t-shirt?

$y = 6$ is the horizontal asymptote, Also the shirts could never be free.

Totally t-shirts charges a \$50 design fee and then charges \$8 per t-shirt.

- H. 8. Write an equation to find the Cost per t-shirt, C, if you buy t t-shirts.

$$C = \frac{50 + 8t}{t}$$

- I. 9. What is the domain? (ie the possible number of shirts you can buy)

$$[1, \infty)$$

- J. 10. What is the range? (ie the lowest and highest possible cost per t-shirt)

$$(8, 58]$$

- K. 11. You expect to buy 75 t-shirts. Which company has the better deal and how much would you need to charge for the t-shirts to break even (ie what is the average cost of a t-shirt if you buy 75)?

$$100 + 6(75) = 550$$

~~550~~ \$550
\$7.33 per shirt

or

$$50 + 8(75) = 650$$

\$650

Terrific T's
charge at least
\$7.33

You have two choices in Cell-phone contracts. Plan A is \$40 per month and includes everything, even a phone. Plan B is only \$30 per month, but you have to buy a phone for \$100.

A. What is the cost for 1 month of each service?

Plan A: $40m = \$40$

Plan B: $100 + 30m = \$130$

B. Write an equation to find the total cost of Plan B if you kept Plan B for m months.

$$C(B) = 100 + 30m$$

C. To find the average monthly cost for plan B, you have to divide the total cost (part 2) by the number of months, m . Write the equation that represents average Cost per month for Plan B.

$$C = \frac{100 + 30m}{m}$$

D. Put your equation from part 3 in "y=". Using the table, what happens to average cost as your number of months goes up?

lowers, + levels off at \$30 per month

Horizontal Asymptote

E. Which plan has a lower average cost if you stay with the plan for 12 months?

$$\frac{40(12)}{12} = \$40$$

vs.

$$\frac{100 + 30(12)}{12} = \$38.33$$

Plan B

F. What is the range of plan B average monthly cost? (ie what is the highest average monthly cost, ie keeping the plan for just 1 month and what is the lowest average monthly cost, ie if you keep the plan a really long time)

Long time
1mo

~~30~~
(30, 130]

$$30 < y \leq 130$$

Work

JOB
Time

Ms. Ray and Mrs. Blanton want to decorate their new classroom. If Ms. Ray works alone it will take her 2 hours and if Mrs. Blanton works alone it will take her 4 hours.

A. If they work together to decorate their new room, do you think they would finish faster?

YES

B. What is rate at which Ms. Ray can decorate the room ($\frac{\#rooms}{hour(s)}$)?

$$\frac{1}{2}$$

C. What is the rate at which Mrs. Blanton can decorate the room ($\frac{\#rooms}{hour(s)}$)?

$$\frac{1}{4}$$

D. What is the rate at which they can both decorate the room together? ($\frac{\#rooms}{hour(s)}$...if you do not know one of the values leave it as x)?

$$\frac{1}{x}$$

E. Now set up an equation. (Ray + Blanton = Together).

$$\frac{1}{2} + \frac{1}{4} = \frac{1}{x}$$

F. Solve for x to find out how long it takes for them to paint the room together.

1 hour 20 min $\frac{3}{4} = \frac{1}{x}$ $\frac{3x}{3} = \frac{4}{3}$ $x = \frac{4}{3}$ hour

Ashley and Lindsay want to start a business painting fences. They figured out that they would paint a 200 ft fence in 40 minutes together. Ashley can paint the fence in 70 minutes alone.

A. What is Ashley's rate? (think about this as painting 1 fence rather than 200 feet of fence and the work will be simpler.)

$$\frac{1}{70}$$

B. What is Lindsay's rate?

$$\frac{1}{x}$$

C. What is the rate they can decorate the room together?

$$\frac{1}{40}$$

D. Write an equation: (Ashley + Lindsay = Together)

$$\frac{1}{70} + \frac{1}{x} = \frac{1}{40}$$

$$\frac{1}{x} = \frac{1}{40} - \frac{1}{70}$$

E. How long would it take for Lindsay to paint the fence alone?

$x = 93.\overline{33}$
93 min 20 seconds

~~1/x~~
 $x = \frac{3}{280}$

~~280/3~~
 $\frac{280}{3} = \frac{3x}{3}$

Mrs. Zurek is putting toys in a toy box at the same time her son, Noah is taking them out. Mrs. Zurek can fill the toy box in 3 minutes and her son can empty the boy in 5 min.

A. What is Mrs. Zurek's rate? (again think about this as 1 task)

$$\frac{1}{3}$$

B. What is Noah's rate?

$$\frac{1}{5}$$

C. Write the equation (Zurek - Noah = Together since they are working against each other in this situation.)

$$\frac{1}{3} - \frac{1}{5} = \frac{1}{x}$$

D. How long will it take her to fill the box if Noah is emptying the box at the same time?

$$\frac{5}{15} - \frac{3}{15} = \frac{2}{15} = \frac{1}{x}$$

$$\frac{2x}{2} = \frac{15}{2}$$

$$x = 7.5 \text{ min}$$

Kyle can paint a room in 4 hours. Cole can paint the same room in 3 hours.

A. What is Kyle's rate?

$$\frac{1}{4}$$

B. What is Cole's rate?

$$\frac{1}{3}$$

C. Write an equation (Kyle + Cole = Together):

$$\frac{1}{4} + \frac{1}{3} = \frac{1}{x}$$

D. If Kyle and Cole were to work together how long would it take to paint the room?

$$\frac{3}{12} + \frac{4}{12} = \frac{1}{x}$$

$$\frac{7}{12} = \frac{1}{x}$$

$$\frac{7x}{7} = \frac{12}{7}$$

$$1 \text{ hour } 43 \text{ min}$$

$$x = 1.714 \dots$$

Rational Word Problems
Average Cost, Work

Name Mrs. Benton

Stan can load his truck in 24 minutes. If Chris helps him, it takes 15 minutes to load the truck. How long does it take Chris alone?

a) Set up equation. (Stan + Chris = Together)

$$\frac{1}{24} + \frac{1}{x} = \frac{1}{15}$$

b) Solve for the variable. What does your answer tell you about the situation?

$$\frac{1}{x} = \frac{1}{15} - \frac{1}{24} \quad \frac{1}{x} = \frac{1}{40}$$

$$\boxed{40 = x}$$

x = Chris Alone

2. The members of our math dept. are ordering Pi Day T-shirts. There is a one-time charge of \$99 for artwork on the T-shirts and a \$12 charge for each T-shirt ordered. If t represents the number of T-shirts ordered, write an equation that represents the total cost, C , in dollars per T-shirt ordered.

$$C = \frac{99 + 12t}{t}$$

a) What is the most expensive price shirts could be? (imagine only 1 person orders a shirt)

$$\frac{99 + 12(1)}{1} = \$111$$

b) What is the cheapest price shirts can be?

12

What is the range for the cost of the shirts?

$$(12, 111]$$

3. A tank can be filled using pipes A, B or both. It takes pipe A, working alone, 18 hours to fill the tank. It takes both pipes, working together, 9.9 hours to fill the tank. How long does it take pipe B, working alone, to fill the tank?

a) Set up equation. (A + B = together)

$$\frac{1}{18} + \frac{1}{B} = \frac{1}{9.9}$$

b) Solve for the variable. What does your answer tell you about the situation?

$$\frac{1}{B} = \frac{1}{9.9} - \frac{1}{18} \quad \frac{1}{B} = \frac{1}{22}$$

B = alone

$$\boxed{B = 22}$$

4. Mr. Loney can fill a calculator case in 4 minutes. One of his students, Brandon, can empty the case in one minute. How long would it take Brandon to empty the case if Mr. Loney keeps filling it up at the same time?

a) Set up equation. (Brandon - Loney = together)

$$\frac{1}{1} - \frac{1}{4} = \frac{1}{x}$$

b) Solve for the variable. What does your answer tell you about the situation?

$$\frac{3}{4} = \frac{1}{x}$$

$$\frac{3x}{3} = \frac{4}{3}$$

$$\boxed{x = \frac{4}{3} \text{ min}}$$

$$\boxed{1 \text{ min } 20 \text{ sec}}$$

5. You have subscribed to a cable television service. The cable company charges you a one-time installation fee of \$30, and a monthly fee of \$50. The function gives the average cost per month as a function of the number of months you have subscribed to the service:

$$C = \frac{30+50m}{m}$$

a) What is the most expensive price per month for cable?

$$\frac{30+50(1)}{1} = \$80$$

b) What is the cheapest price per month for cable?

$$\$50$$

c) What is the range for the average monthly cost for cable?

$$[50, 80]$$

6. You are organizing your high school's sports banquet. The banquet rental hall is \$350. In addition to this one time charge, the meal will cost \$8.50 per plate. Mr. Spain has decided that you can only go if the cost per student $C(x)$, is below \$15. Write an inequality that could be used to find the number of students, x needed to offer the banquet?

$$\frac{350+8.50x}{x} < 15$$

a) What is the most expensive price the meal could cost?

$$350+8.50(1)$$

b) What is the cheapest meals can be?

$$8.50$$

c) What is the range for the cost of the meals?

$$[8.50, 358.50]$$

7. At 10 AM Danny's father asks him to weed the garden. Danny knows this will take him 4 hours working alone. When it is his older brother Mike's turn to do the job, it takes Mike 6 hours working alone. Since Mike and Danny have a golf reservation at 1 PM, they agree to work together. When will they finish if they work together?

a) Set up equation. (Danny + Mike = together)

$$\frac{1}{4} + \frac{1}{6} = \frac{1}{x}$$

b) Solve for the variable. What does your answer tell you about the situation?

$$\frac{6}{24} + \frac{4}{24}$$

$$10x = 24$$

$$\frac{10}{24} = \frac{1}{x}$$

$$x = 2.4 \text{ hours}$$

$$.4 \text{ hours} =$$

$$24 \text{ min}$$

done @ 12:24