

USING EQUATIONS TO SOLVE PROBLEMS – A DEEPER LOOK

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PRACTICE: USING EQUATIONS TO SOLVE PROBLEMS

Important Principles to Keep in Mind

- There is a great deal of information that is embedded within the statement of a problem.
- Part of the statement will tell you how the unknowns are related to each other.
- Another part will tell you how to write an equation relating the unknowns.
- Yet another part will tell you what you are required to find.

Easy (E)

1. Allan paid \$340 to have his car fixed at an auto-repair shop. The parts of the car cost \$215 and service was charged at \$25 per hour. How many hours did it take to repair the car?
2. The sum of three consecutive even positive integers is 222. Find the integers.
3. Vyshna thinks of five secret numbers that he wants Vraj to guess. He gave the following hints to Vraj:
“The second number is two more than the first, the third number is four more than the second, the fourth number is six more than the third and the fifth number is eight more than the fourth. Furthermore, the numbers add up to fifty-five.”

What are the five numbers?
4. The perimeter of a rectangular lot is 200 m. The length of the lot is 10 m more than twice its width. Find the dimensions of the lot.

Moderate (M)

1. Zeus and Leto have a son named Apollo. Zeus is five years older than twice his son's age and Leto's age is the sum of Apollo's age and one-third of Zeus' age. If the sum of all their ages is 100, find each of their ages.
2. Victoria can finish typing an essay in five hours while Jenny can type the same essay in eight hours. How long will it take them to type the essay if they work together?
3. Basmati rice costs \$4.50/kg while wild rice costs \$5.40/kg. In what ratio should the basmati rice be mixed with wild rice to create a blend that costs \$5.00/kg?
4. Two trains leave a station at the same time but travel in opposite directions. One moves at a constant speed of 140 km/h while the other rolls along at a speed of 120 km/h. How long does it take for the distance between the trains to reach 390 km?

Difficult (D)

1. A train travelling nonstop to its destination makes the trip at an average speed of 72 km/h. On the return trip, the train makes several stops and is only able to average 48 km/h. If the return trip takes two hours longer than the initial trip to the destination, then what is the travel time each way?
2. Diophantus of Alexandria was a Greek mathematician who lived between 200 AD and 300 AD. He was a child for one-sixth of his life, a youth for one-twelfth of his life and a bachelor for one-seventh more. Five years after he married, his son was born. Diophantus' son died four years before his father at half his father's final age. How old was Diophantus when he died?

Answers

E1. 5 **E2.** 72, 74, 76 **E3.** 3, 5, 9, 15, 23 **E4.** 30 m, 70 m **M1.** Apollo 20, Zeus 45, Leto 35 **M2.** $40/13$ h $\div$ 3 h, 5 min
M3. 4 parts basmati to 5 parts wild (4/9 basmati and 5/9 wild) **M4.** 1.5 h **D1.** 4 h to destination, 6 h return **D2.** 84

TIPS PROBLEMS INVOLVING EQUATIONS

1. In $\triangle ABC$, the measure of $\angle ABC$ is double the measure of $\angle CAB$. The measure of $\angle BCA$ is 30° greater than the measure of the smaller of the other two angles. Find the measure of each angle.

2. Naquan is saving nickels and dimes in a jar. The jar contains 10 more nickels than dimes. Altogether, the value of the coins is \$16.25. How many nickels and dimes are in the jar?

<i>Coin</i>	<i>Value of One Coin</i>	<i>Number of Coins</i>	<i>Value of Coins</i>
Dime	\$0.10	d	
Nickel	\$0.05		
Total	N/A		\$16.25



Nickel = 5^c =



Dime = 10^c =

3. Solution A is 50% hydrochloric acid by volume, while solution B is 75% hydrochloric acid by volume. How many litres of each solution should be used to make 100 litres of a solution which is 60% hydrochloric acid by volume?

Solution (of Problem)

<i>Solution</i>	<i>% of acid</i>	<i>Volume of the Solution (L)</i>	<i>Volume of Acid in the Solution (L)</i>
Solution A	50% = 0.5	a	
Solution B	75% = 0.75		
Mixture	60% = 0.6	100	

4. To make lower-fat chocolate frozen yogurt, chocolate milk containing 2% butterfat is needed. To obtain the required percentage of butterfat, chocolate milk containing 4% butterfat is mixed with 500 litres of chocolate milk containing 1% butterfat.
- (a) Without performing any calculations, predict whether the mixture will contain more of the 1% chocolate milk or more of the 4% chocolate milk. Explain.
- (b) How many litres of the 4% chocolate milk are needed to create the required mixture? What is the total volume of the mixture?

Solution

Let x represent the number of litres of the 4% chocolate milk that must be mixed with 500 L of the 1% chocolate milk to produce a mixture containing 2% butterfat.

<i>Type of Chocolate Milk</i>	<i>Volume (L)</i>	<i>Amount of Butterfat in Given Volume (L)</i>
1% butterfat	500	
4% butterfat	x	
2% butterfat mixture		

- (c) Does your answer in part (b) agree with the prediction that you made in part (a)? What can you conclude from this?

MORE TIPS PROBLEMS INVOLVING EQUATIONS

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1. In a two-digit number, the tens digit is four times the units digit. When the digits are reversed, the new number formed is fifty-four less than the original number. Find the original number.
2. Anil is nine years older than Amandeep. In ten years, Anil will be twice as old as Amandeep was ten years ago. Find their present ages.
3. The distance between two places A and B is 240 km. A motorcyclist starts from A at the same time that a pedestrian starts from B. The speed of the motorcyclist is fifteen times that of the pedestrian. Three hours after they start, they meet at point M. How far is this point from both A and B?
4. Three integers are unknown but are related to each other. The second integer is three times the first integer and one-fifth of the third integer. If the sum of the three integers is 266, find the value of each integer.

Answers

1. 82, 28 2. 39, 48 3. 225 km, 15 km 4. 14, 42, 210