Rate Problems: Distance and Time, Work, Mixture, and Cost

Word Problem Setup

200. Some problems require translation of words into algebraic expressions or equations. For example: 8 more than 7 times a number is 22. Find the number. Let n = the number. We have

$$7n + 8 = 22 \qquad 7n = 14 \qquad n = 2$$

Another example: There are 3 times as many boys as girls in a class. What is the ratio of boys to the total number of students? Let n = number of girls. Then

$$3n = \text{number of boys}$$
$$4n = \text{total number of students}$$
$$\frac{\text{number of boys}}{\text{total students}} = \frac{3n}{4n} = \frac{3}{4}$$

201. Rate problems concern a special type of relationship that is very common: rate × input = output. This results from the definition of rate as *the ratio between output and input*. In these problems, input may represent any type of "investment," but the most frequent quantities used as inputs are time, work, and money. Output is usually distance traveled, work done, or money spent.

Note that the word *per*, as used in rates, signifies a ratio. Thus a rate of 25 miles per hour signifies the ratio between an output of 25 miles and an input of 1 hour.

Frequently, the word *per* will be represented by the fraction sign, thus $\frac{\text{25 miles}}{\text{1 hour}}$.

> **Example:** Peter can walk a mile in 10 minutes. He can travel a mile on his bicycle in 2 minutes. How far away is his uncle's house if Peter can walk there and bicycle back in 1 hour exactly?

To solve a rate problem such as the one above, follow these steps:

STEP 1. Determine the names of the quantities that represent input, output, and rate in the problem you are doing. In the example, Peter's input is *time*, and his output is *distance*. His rate will be *distance per unit of time*, which is commonly called *speed.*

STEP 2. Write down the fundamental relationship in terms of the quantities mentioned, making each the heading of a column. In the example, set up the table like this:

$$\text{speed} \times \text{time} = \text{distance}$$

STEP 3. Directly below the name of each quantity, write the unit of measurement in terms of the answer you want. Your choice of unit should be the most convenient one, but remember, once you have chosen a unit, you must convert all quantities to that unit.

We must select a unit of time. Since a *minute* was the unit used in the problem, it is the most logical choice. Similarly, we will choose a *mile* for our unit of distance. *Speed* (which is the ratio of distance to time) will therefore be expressed in *miles per minute*, usually abbreviated as mi/min. Thus, our chart now looks like this:

speed × time = distance

mi/min	minutes	miles

STEP 4. The problem will mention various situations in which some quantity of input is used to get a certain quantity of output. Represent each of these situations on a different line of the table, leaving blanks for unknown quantities.

In the sample problem, four situations are mentioned: Peter can walk a mile in 10 minutes; he can bicycle a mile in 2 minutes; he walks to his uncle's house; and he bicycles home. On the diagram, with the appropriate boxes filled, the problem will look like this:

speed × time = distance

	mi/min	minutes	miles
1. walking		10	1
2. bicycling		2	1
3. walking			
4. bicycling			

STEP 5. From the chart and from the relationship at the top of the chart, quantities for filling some of the empty spaces may become obvious. Fill in these values directly.

In the example, on the first line of the chart, we see that the walking speed × 10 equals 1.

Thus, the walking *speed* is 0.1 mi/min (mi/min × 10 = 1 mi; mi/min = $\frac{1 \text{ mi}}{10 \text{ min}}$ = 0.1).

Similarly, on the second line we see that the bicycle speed equals 0.5 mi/min. Furthermore, his walking speed shown on line 3 will be 0.1, the same speed as on line 1; and his bicycling speed shown on line 4 will equal the speed (0.5) shown on line 2. Adding this information to our table, we get:

speed × time = distance

	mi/min	minutes	miles
1. walking	0.1	10	1
2. bicycling	0.5	2	1
3. walking	0.1		
4. bicycling	0.5		

STEP 6. Next, fill in the blanks with algebraic expressions to represent the quantities indicated, being careful to take advantage of simple relationships stated in the problem or appearing in the chart.

Continuing the example, we represent the time spent traveling shown on line 3 by x. According to the fundamental relationship, the distance traveled on this trip must be $(0.1)x$. Similarly, if y represents the time shown on line 4, the distance traveled is $(0.5)y$. Thus our chart now looks like this:

speed × time = distance

	mi/min	minutes	miles
1. walking	**0.1**	**10**	**1**
2. bicycling	**0.5**	**2**	**1**
3. walking	**0.1**	x	**(0.1)**x
4. bicycling	**0.5**	y	**(0.5)**y

STEP 7. Now, from the statement of the problem, you should be able to set up enough equations to solve for all the unknowns. In the example, there are two facts that we have not used yet. First, since Peter is going to his uncle's house and back, it is assumed that the distances covered on the two trips are equal. Thus we get the equation $(0.1)x = (0.5)y$. We are told that the total time to and from his uncle's house is one hour. Since we are using minutes as our unit of time, we convert the one hour to 60 minutes. Thus we get the equation: $x + y = 60$. Solving these two equations ($0.1x = 0.5y$ and $x + y = 60$) algebraically, we find that $x = 50$ and $y = 10$. (See Section 407 for the solution of simultaneous equations.)

STEP 8. Now that you have all the information necessary, you can calculate the answer required. In the sample problem, we are required to determine the distance to the uncle's house, which is $(0.1)x$ or $(0.5)y$. Using $x = 50$ or $y = 10$ gives us the distance as 5 miles.

Now that we have shown the fundamental steps in solving a rate problem, we shall discuss various types of rate problems.

Distance and Time

202. In *distance and time problems* the fundamental relationship that we use is *speed* × *time* = *distance*. Speed is the rate, time is the input, and distance is the output. The example in Section 201 was this type of problem.

> **Example:** In a sports-car race, Danica gives Pablo a head start of 10 miles. Danica's car goes 80 miles per hour and Pablo's car goes 60 miles per hour. How long should it take Danica to catch up to Pablo if they both leave their starting marks at the same time?

STEP 1. Here the fundamental quantities are *speed*, *time*, and *distance*.

STEP 2. The fundamental relationship is speed × time = distance. Write this at the top of the chart.

STEP 3. The unit for *distance* in this problem will be a *mile*. The unit for *speed* will be *miles per hour*. Since the speed is in miles per hour, our *time* will be in *hours*. Now our chart looks like this:

speed × time = distance

mi/hr	hours	miles

STEP 4. The problem offers us certain information that we can add to the chart. First we must make two horizontal rows, one for Pablo and one for Danica. We know that Pablo's speed is 60 miles per hour and that Danica's speed is 80 miles per hour.

STEP 5. In this case, none of the information in the chart can be used to calculate other information in the chart.

STEP 6. Now we must use algebraic expressions to represent the unknowns. We know that both Pablo and Danica travel for the same amount of time, but we do not know for how much time, so we will place an x in the space for each driver's time. Now from the relationship of speed × time = distance, we can calculate Pablo's distance as $60x$ and Danica's distance as $80x$. Now the chart looks like this:

speed × **time** = **distance**

	mi/hr	hours	miles
Pablo	**60**	x	**60**x
Danica	**80**	x	**80**x

STEP 7. From the statement of the problem we know that Danica gave Pablo a 10-mile head start. In other words, Danica's distance is 10 more miles than Pablo's distance. This can be stated algebraically as $60x + 10 = 80x$. That is, Pablo's distance + 10 miles = Danica's distance.

Solving for x gives us $x = \frac{1}{2}$.

STEP 8. The question asks how much time is required for Danica to catch up to Pablo. If we look at the chart, we see that this time is x, and x has already been calculated as $\frac{1}{2}$, so the answer is $\frac{1}{2}$ hour.

Work

203. In *work problems* the input is time and the output is the amount of work done. The rate is the work per unit of time.

Example: Jack can chop down 20 trees in 1 hour, whereas it takes Ted $1\frac{1}{2}$ hours to chop down 18 trees. If the two of them work together, how long will it take them to chop down 48 trees?

Solution: By the end of Step 5 your chart should look like this:

rate × **time** = **work**

	trees/hr	hours	trees
1. Jack	**20**	**1**	**20**
2. Ted	**12**	$1\frac{1}{2}$	**18**
3. Jack	**20**		
4. Ted	**12**		

In Step 6, we represent the time that it takes Jack by x in line 3. Since we have the relationship that rate × time = work, we see that in line 3 the work is $20x$. Since the two boys work together (therefore, for the same amount of time), the time in line 4 must be x, and the work must be $12x$. Now, in Step 7, we see that the total work is 48 trees. From lines 3 and 4, then, $20x + 12x = 48$. Solving for x gives us $x = 1\frac{1}{2}$. We are asked to find the number of hours needed by the boys to chop down the 48 trees together, and we see that this time is x, or $1\frac{1}{2}$ hours.

Mixture

204. In *mixture problems* you are given a percent or a fractional composition of a substance, and you are asked questions about the weights and compositions of the substance. The basic relationship here is that the percentage of a certain substance in a mixture × the amount of the mixture = the amount of substance.

Note that it is often better to change percentages to decimals because it makes it easier to avoid errors.

Example: A chemist has two quarts of 25% acid solution and one quart of 40% acid solution. If he mixes these, what will be the concentration of the mixture?

Solution: Let x = concentration of the mixture. At the end of Step 6, our table will look like this:

concentration × **amount of sol** = **amount of acid**

	$\frac{\text{qt (acid)}}{\text{qt (sol)}}$	qts (sol)	qts (acid)
25% solution	**0.25**	**2**	**0.50**
40% solution	**0.40**	**1**	**0.40**
mixture	x	**3**	$3x$

We now have one additional bit of information: The amount of acid in the mixture must be equal to the total amount of acid in each of the two parts, so $3x = 0.50 + 0.40$. Therefore x is equal to 0.30, which is the same as a 30% concentration of the acid in the mixture.

Cost

205. In *cost problems* the rate is the *price per item*, the input is the *number of items*, and the output is the *value* of the items considered. When you are dealing with dollars and cents, you must be very careful to use the decimal point correctly.

Example: Jim has $3.00 in nickels and dimes in his pocket. If he has twice as many nickels as he has dimes, how many coins does he have altogether?

Solution: After Step 6, our chart should look like this (where c is the number of dimes Jim has):

rate × **number** = **value**

	cents/coin	coins	cents
nickels	**5**	$2c$	$10c$
dimes	**10**	c	$10c$

Now we recall the additional bit of information that the total value of the nickels and dimes is $3.00, or 300 cents. Thus, $5(2c) + 10c = 300$; $20c = 300$; so $c = 15$, the number of dimes. Jim has twice as many nickels, so $2c = 30$.

The total number of coins is $c + 2c = 3c = 45$.

The following table will serve as review for this Refresher Section.

TYPE OF PROBLEM	FUNDAMENTAL RELATIONSHIP
distance	**speed × time = distance**
work	**rate × time = work done**
mixture	**concentration × amount of solution = amount of ingredient**
cost	**rate × number of items = cost**

Practice Test 2

Rate Problems: Distance and Time, Work, Mixture, and Cost

Correct answers and solutions follow each test.

1. A B C D E

1. A person rowed 3 miles upstream (against the current) in 90 minutes. If the river flowed with a current of 2 miles per hour, how long did the person's return trip take?

(A) 20 minutes
(B) 30 minutes
(C) 45 minutes
(D) 60 minutes
(E) 80 minutes

2. A B C D E

2. Aaron can do a job in 1 hour, Camilla can do the same job in 2 hours, and Bob can do the job in 3 hours. How long does it take them to do the job working together?

(A) $\frac{6}{11}$ hour
(B) $\frac{1}{2}$ hour
(C) 6 hours
(D) $\frac{1}{3}$ hour
(E) $\frac{1}{6}$ hour

3. A B C D E

3. Mr. Cheung had $2,000 to invest. He invested part of it at 5% per year and the remainder at 4% per year. After one year, his investment grew to $2,095. How much of the original investment was at the 5% rate?

(A) $500
(B) $750
(C) $1,000
(D) $1,250
(E) $1,500

4. A B C D E

4. Gabriel walks down the road for half an hour at an average speed of 3 miles per hour. He waits 10 minutes for a bus, which brings him back to his starting point at 3:15. If Gabriel began his walk at 2:25 the same afternoon, what was the average speed of the bus?

(A) 1.5 miles per hour
(B) 3 miles per hour
(C) 4.5 miles per hour
(D) 6 miles per hour
(E) 9 miles per hour

5. A B C D E

5. Faucet A lets water flow into a 5-gallon tub at a rate of 1.5 gallons per minute. Faucet B lets water flow into the same tub at a rate of 1.0 gallon per minute. Faucet A runs alone for 100 seconds; then the two of them together finish filling up the tub. How long does the whole operation take?

(A) 120 seconds
(B) 150 seconds
(C) 160 seconds
(D) 180 seconds
(E) 190 seconds

6. A B C D E

6. Coffee A normally costs 75¢ per pound. It is mixed with Coffee B, which normally costs 80¢ per pound, to form a mixture that costs 78¢ per pound. If there are 10 pounds of the mix, how many pounds of Coffee A were used in the mix?

(A) 3
(B) 4
(C) 4.5
(D) 5
(E) 6

7. A B C D E

7. If an athlete can run p miles in x minutes, how long will it take her to run q miles at the same rate?

(A) $\frac{pq}{x}$ minutes

(B) $\frac{px}{q}$ minutes

(C) $\frac{q}{px}$ minutes

(D) $\frac{qx}{p}$ minutes

(E) $\frac{x}{pq}$ minutes

8. A B C D E

8. A train went 300 miles from City X to City Y at an average rate of 80 mph. At what speed did it travel on the way back if its average speed for the whole trip was 100 mph?

(A) 120 mph

(B) 125 mph

(C) $133\frac{1}{3}$ mph

(D) $137\frac{1}{2}$ mph

(E) 150 mph

9. A B C D E

9. Kaylee spent exactly $2.50 on 3¢, 6¢, and 10¢ stamps. If she bought ten 3¢ stamps and twice as many 6¢ stamps as 10¢ stamps, how many 10¢ stamps did she buy?

(A) 5
(B) 10
(C) 12
(D) 15
(E) 20

10. A B C D E

10. If 6 workers can complete 9 identical jobs in 3 days, how long will it take 4 workers to complete 10 such jobs?

(A) 3 days
(B) 4 days
(C) 5 days
(D) 6 days
(E) more than 6 days

11. A B C D E

11. A barge travels twice as fast when it is empty as when it is full. If it travels 20 miles north with a cargo, spends 20 minutes unloading, and returns to its original port empty, taking 8 hours to complete the entire trip, what is the speed of the barge when it is empty?

(A) less than 3 mph
(B) less than 4 mph but not less than 3 mph
(C) less than 6 mph but not less than 4 mph
(D) less than 8 mph but not less than 6 mph
(E) 8 mph or more

12. A B C D E

12. Liam can hammer 20 nails in 6 minutes. Jordan can do the same job in only 5 minutes. How long will it take them to finish if Liam hammers the first 5 nails, then Jordan hammers for 3 minutes, then Liam finishes the job?

(A) 4.6 minutes
(B) 5.0 minutes
(C) 5.4 minutes
(D) 5.8 minutes
(E) 6.0 minutes

13. A B C D E

13. Jessica has two quarts of a 30% acid solution and three pints of a 20% solution. If she mixes them, what will be the concentration (to the nearest percent) of the resulting solution? (1 quart = 2 pints.)

(A) 22%
(B) 23%
(C) 24%
(D) 25%
(E) 26%

14. A B C D E

14. Luiz has 12 coins totaling $1.45. None of his coins is larger than a quarter. Which of the following *cannot* be the number of quarters he has?

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

15. A B C D E

15. Olivia's allowance is $1.20 per week. Colton's is 25¢ per day. If they save both their allowances together, how long will they have to save before they can get a model car set that costs $23.60?

(A) 6 weeks
(B) 8 weeks
(C) 10 weeks
(D) 13 weeks
(E) 16 weeks

16. A B C D E

16. Matt can earn money at the following schedule: $2.00 for the first hour, $2.50 an hour for the next two hours, and $3.00 an hour after that. He also has the opportunity of taking a different job that pays $2.75 an hour. He wants to work until he has earned $15.00. Which of the following is true?

(A) The first job will take him longer by 15 minutes or more.
(B) The first job will take him longer by less than 15 minutes.
(C) The two jobs will take the same length of time.
(D) The second job will take him longer by 30 minutes or more.
(E) The second job will take him longer by less than 10 minutes.

17. A B C D E

17. If Robert can seal 40 envelopes in one minute, and Paul can do the same job in 80 seconds, how many minutes (to the nearest minute) will it take the two of them, working together, to seal 350 envelopes?

(A) 4 minutes
(B) 5 minutes
(C) 6 minutes
(D) 7 minutes
(E) 8 minutes

18. A B C D E

18. Towns A and B are 400 miles apart. If a train leaves A in the direction of B at 50 miles per hour, how long will it take before that train meets another train, going from B to A, at a speed of 30 miles per hour? (Note: The train that leaves B departs at the same time as the train that leaves A.)

(A) 4 hours

(B) $4\frac{1}{3}$ hours

(C) 5 hours

(D) $5\frac{2}{3}$ hours

(E) $6\frac{2}{3}$ hours

19. A B C D E

19. A rectangular tub has internal measurements of 2 feet × 2 feet × 5 feet. If two faucets, each with an output of 2 cubic feet of water per minute, pour water into the tub simultaneously, how many minutes does it take to fill the tub completely?

(A) less than 3 minutes
(B) less than 4 minutes, but not less than 3
(C) less than 5 minutes, but not less than 4
(D) less than 6 minutes, but not less than 5
(E) 6 minutes or more

20. A B C D E

20. A 30% solution of barium chloride is mixed with 10 grams of water to form a 20% solution. How many grams were in the original solution?

(A) 10
(B) 15
(C) 20
(D) 25
(E) 30

21. A B C D E

21. Mr. Chan had a coin collection including only nickels, dimes, and quarters. He had twice as many dimes as he had nickels, and half as many quarters as he had nickels. If the total face value of his collection was $300.00, how many quarters did the collection contain?

(A) 75
(B) 100
(C) 250
(D) 400
(E) 800

22. A B C D E

22. Pullig's Office Supply Store stocks a higher-priced pen and a lower-priced pen. If the store sells the higher-priced pens, which yield a profit of $1.20 per pen sold, it can sell 30 in a month. If the store sells the lower-priced pens, making a profit of 15¢ per pen sold, it can sell 250 pens in a month. Which type of pen will yield more profit per month, and by how much?

(A) The cheaper pen will yield a greater profit, by $1.50.
(B) The more expensive pen will yield a greater profit, by $1.50.
(C) The cheaper pen will yield a greater profit, by 15¢.
(D) The more expensive pen will yield a greater profit, by 15¢.
(E) Both pens will yield exactly the same profit.

23. A B C D E

23. At a cost of $2.50 per square yard, what would be the price of carpeting a rectangular floor, 18 feet × 24 feet?

(A) $120
(B) $360
(C) $750
(D) $1,000
(E) $1,080

24. A B C D E

24. Sarita and Elizabeth agreed to race across a 50-foot pool and back again. They started together, but Sarita finished 10 feet ahead of Elizabeth. If their rates were constant, and Sarita finished the race in 27 seconds, how long did it take Elizabeth to finish?

(A) 28 seconds
(B) 30 seconds
(C) $33\frac{1}{3}$ seconds
(D) 35 seconds
(E) 37 seconds

25. A B C D E

25. If four campers need $24.00 worth of food for a three-day camping trip, how much will two campers need for a two-week trip?

(A) $12.00
(B) $24.00
(C) $28.00
(D) $42.00
(E) $56.00

26. A B C D E

26. Wilson walks 15 blocks to work every morning at a rate of 2 miles per hour. If there are 20 blocks in a mile, how long does it take him to walk to work?

(A) $12\frac{1}{2}$ minutes
(B) 15 minutes
(C) $22\frac{1}{2}$ minutes
(D) $37\frac{1}{2}$ minutes
(E) 45 minutes

27. A B C D E

27. Logan River has a current of 3 miles per hour. A boat takes twice as long to travel upstream between two points as it does to travel downstream between the same two points. What is the speed of the boat in still water?

(A) 3 miles per hour
(B) 6 miles per hour
(C) 9 miles per hour
(D) 12 miles per hour
(E) The speed cannot be determined from the given information.

28. A B C D E

28. Raj can run 10 miles per hour, whereas Sheldon can run only 8 miles per hour. If they start at the same time from the same point and run in opposite directions, how far apart (to the nearest mile) will they be after 10 minutes?

(A) 1 mile
(B) 2 miles
(C) 3 miles
(D) 4 miles
(E) 5 miles

29. A B C D E

29. Machine A can produce 40 bolts per minute, whereas Machine B can produce only 30 per minute. Machine A begins alone to make bolts, but it breaks down after $1\frac{1}{2}$ minutes, and Machine B must complete the job. If the job requires 300 bolts, how long does the whole operation take?

(A) $7\frac{1}{2}$ minutes
(B) 8 minutes
(C) $8\frac{1}{2}$ minutes
(D) 9 minutes
(E) $9\frac{1}{2}$ minutes

30. A B C D E

30. Ten pints of 15% salt solution are mixed with 15 pints of 10% salt solution. What is the concentration of the resulting solution?

(A) 10%
(B) 12%
(C) 12.5%
(D) 13%
(E) 15%

31. A B C D E

31. Jeff makes \$50 every day, from which he must spend \$30 a day for various expenses. Pete makes \$100 a day but has to spend \$70 each day for expenses. If the two of them save together, how long will it take before they can buy a \$1,500 used car?

(A) 10 days
(B) 15 days
(C) 30 days
(D) 50 days
(E) 75 days

32. A B C D E

32. Two cities are 800 miles apart. At 3:00 P.M., Plane A leaves one city, traveling toward the other city at a speed of 600 miles per hour. At 4:00 the same afternoon, Plane B leaves the first city, traveling in the same direction at a rate of 800 miles per hour. Which of the following answers represents the actual result?

(A) Plane A arrives first, by an hour or more.
(B) Plane A arrives first, by less than an hour.
(C) The two planes arrive at exactly the same time.
(D) Plane A arrives after Plane B, by less than an hour.
(E) Plane A arrives after Plane B, by an hour or more.

33. A B C D E

33. Sanjay has as many nickels as Doug has dimes; Doug has twice as many nickels as Sanjay has dimes. If together they have \$2.50 in nickels and dimes, how many nickels does Sanjay have?

(A) 1 nickel
(B) 4 nickels
(C) 7 nickels
(D) 10 nickels
(E) The answer cannot be determined from the given information.

34. A B C D E

34. A delivery truck can travel 120 miles in either of two ways. It can travel at a constant rate of 40 miles per hour, or it can travel halfway at 50 miles per hour, then slow down to 30 miles per hour for the second 60 miles. Which way is faster, and by how much?

(A) The constant rate is faster by 10 minutes or more.
(B) The constant rate is faster by less than 10 minutes.
(C) The two ways take exactly the same time.
(D) The constant rate is slower by less than 10 minutes.
(E) The constant rate is slower by 10 minutes or more.

35. A B C D E

35. John walks 10 miles at an average rate of 2 miles per hour and returns on a bicycle at an average rate of 10 miles per hour. How long (to the nearest hour) does the entire trip take him?

(A) 3 hours
(B) 4 hours
(C) 5 hours
(D) 6 hours
(E) 7 hours

36. A B C D E

36. If a plane can travel P miles in Q hours, how long will it take to travel R miles?

(A) $\frac{PQ}{R}$ hours

(B) $\frac{P}{QR}$ hours

(C) $\frac{QR}{P}$ hours

(D) $\frac{Q}{PR}$ hours

(E) $\frac{PR}{Q}$ hours

37. A B C D E

37. Alison can swim 75 feet in 12 seconds. What is her rate to the nearest mile per hour?

(A) 1 mph
(B) 2 mph
(C) 3 mph
(D) 4 mph
(E) 5 mph

38. A B C D E

38. How many pounds of a \$1.20-per-pound nut mixture must be mixed with two pounds of a 90¢-per-pound mixture to produce a mixture that sells for \$1.00 per pound?

(A) 0.5
(B) 1.0
(C) 1.5
(D) 2.0
(E) 2.5

39. A B C D E

39. A broken clock is set correctly at 12:00 noon. However, it registers only 20 minutes for each hour. In how many hours will it again register the correct time?

(A) 12
(B) 18
(C) 24
(D) 30
(E) 36

40. A B C D E

40. If a man travels p hours at an average rate of q miles per hour, and then r hours at an average rate of s miles per hour, what is his overall average rate of speed?

(A) $\frac{pq + rs}{p + r}$

(B) $\frac{q + s}{2}$

(C) $\frac{q + s}{p + r}$

(D) $\frac{p}{q} + \frac{r}{s}$

(E) $\frac{p}{s} + \frac{r}{q}$

41. A B C D E

41. If Lily can paint 25 feet of fence in an hour, and Samantha can paint 35 feet in an hour, how many minutes will it take them to paint a 150-foot fence, if they work together?

(A) 150
(B) 200
(C) 240
(D) 480
(E) 500

42. A B C D E

42. If an athlete travels for a half hour at a rate of 20 miles per hour, and for another half hour at a rate of 30 miles per hour, what is the athlete's average speed?

(A) 24 miles per hour
(B) 25 miles per hour
(C) 26 miles per hour
(D) 26.5 miles per hour
(E) The answer cannot be determined from the given information.

43. A B C D E

43. New York is 3,000 miles from Los Angeles. Sol leaves New York aboard a plane heading toward Los Angeles at the same time that Robert leaves Los Angeles aboard a plane heading toward New York. If Sol is moving at 200 miles per hour and Robert is moving at 400 miles per hour, how soon will one plane pass the other?

(A) 2 hours
(B) $22\frac{1}{2}$ hours
(C) 5 hours
(D) 4 hours
(E) 12 hours

44. A B C D E

44. A tourist exchanged a dollar bill for change and received 7 coins, none of which were half dollars. How many of these coins were dimes?

(A) 0
(B) 1
(C) 4
(D) 5
(E) The answer cannot be determined from the information given.

45. A B C D E

45. A chemist adds two quarts of pure alcohol to a 30% solution of alcohol in water. If the new concentration is 40%, how many quarts of the original solution were there?

(A) 12
(B) 15
(C) 18
(D) 20
(E) 24

46. A B C D E

46. The Energy Value Power Company charges 8¢ per kilowatt-hour for the first 1,000 kilowatt-hours, and 6¢ per kilowatt-hour after that. If a man uses a 900-watt toaster for 5 hours, a 100-watt lamp for 25 hours, and a 5-watt clock for 400 hours, how much is he charged for the power he uses? (1 kilowatt = 1,000 watts)

(A) 56¢
(B) 64¢
(C) 72¢
(D) $560.00
(E) $720.00

47. A B C D E

47. At 30¢ per yard, what is the price of 96 inches of ribbon?

(A) 72¢
(B) 75¢
(C) 80¢
(D) 84¢
(E) 90¢

48. A B C D E

48. Maya travels for 6 hours at a rate of 50 miles per hour. Her return trip takes her $7\frac{1}{2}$ hours. What is her average speed for the whole trip?

(A) 44.4 miles per hour
(B) 45.0 miles per hour
(C) 46.8 miles per hour
(D) 48.2 miles per hour
(E) 50.0 miles per hour

49. A B C D E

49. Lucas puts $100 in the bank for two years at 5% interest compounded annually. At the end of the two years, what is his balance?

(A) $100.00
(B) $105.00
(C) $105.25
(D) $110.00
(E) $110.25

50. A B C D E

50. A 12-gallon tub has a faucet that lets water in at a rate of 3 gallons per minute, and a drain that lets water out at a rate of 1.5 gallons per minute. If you start with 3 gallons of water in the tub, how long will it take to fill the tub completely? (Note that the faucet is on and the drain is open.)

(A) 3 minutes
(B) 4 minutes
(C) 6 minutes
(D) 7.5 minutes
(E) 8 minutes