Name: Date:

WORKSHEET :

Word Problems
Distance=Rate × Time

Round all answers to 1 decimal place

1. Maria bikes from her house to Julie's at 20 mph and arrives 30 minutes later. She returns home again at a rate of 10 mph. What is Maria's average speed for the round trip?

2. A 555-mile, 5-hour plane trip was flown at two speeds. For the first part of the trip, the average speed was 105 mph. Then the tailwind picked up, and the remainder of the trip was flown at an average speed of 115 mph. For how long, in hours, did the plane fly at each speed?

3. An executive drove from home at an average speed of 30 mph to an airport where a helicopter was waiting. The executive boarded the helicopter and flew to the corporate offices at an average speed of 60 mph. The entire distance was 150 miles; the entire trip took three hours. Find the distance from the airport to the corporate offices.

4. A car and a bus set out at 2 p.m. from the same point, headed in the same direction. The average speed of the car is 30 mph slower than twice the speed of the bus. In two hours, the car is 20 miles ahead of the bus. Find the rate of the car.

5. Train 1 leaves from point A toward point B 300 miles apart where train 2 leaves at the same time toward point A. If both trains leave at 2PM and Train 1 travels at 90MPH and Train 2 travels at 60MPH, then at what time do the trains pass each other?

WORKSHEET :

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6. Train 1 leaves from point A toward point B 300 miles apart where train 2 leaves at the same time toward point A. If both trains leave at 2PM and Train 1 travels at 90MPH and Train 2 travels at 60MPH, then at what distance from point B do the trains pass each other?

7. A passenger train leaves the train depot 2 hours after a freight train left the same depot. The freight train is traveling 20 mph slower than the passenger train. Find the rate of each train, if the passenger train overtakes the freight train in three hours.

8. Two cyclists start at the same time from opposite ends of a course that is 45 miles long. One cyclist is riding at 14 mph and the second cyclist is riding at 16 mph. How long after they begin will they meet?

9. A boat travels for three hours with a current of 3 mph and then returns the same distance against the current in four hours. What is the boat's speed in calm water? How far did the boat travel one way?

10. A spike is hammered into a train rail. You are standing at the other end of the rail. You hear the sound of the hammer strike both through the air and through the rail itself. These sounds arrive at your point six seconds apart. You know that sound travels through air at 1100 feet per second and through steel at 16,500 feet per second. How far away is that spike?

ANSWERS :

Word Problems
Distance=Rate × Time

1. **Maria bikes from her house to Julie's at 20 mph and arrives 30 minutes later. She returns home again at a rate of 10 mph. What is Maria's average speed for the round trip?**

	Distance	Rate	Time
Leg 1	d	20 mph	0.5 hr
Leg 2	d	10mph	t hr
Total	2d miles	R	t + .5 hr

Equation 1:
d = 20 × 0.5 = 10 miles
Equation 2:
10 miles = 10 × t
t = 10/10 = 1 hour
Equation 3:
2d = 20 miles = R × 1.5 hours
R = 20/1.5 mph = 12.7 mph

2. **A 555-mile, 5-hour plane trip was flown at two speeds. For the first part of the trip, the average speed was 105 mph. Then the tailwind picked up, and the remainder of the trip was flown at an average speed of 115 mph. For how long, in hours, did the plane fly at each speed?**

	Distance	Rate	Time
Leg 1	d miles	105 mph	t hr
Leg 2	555 - d miles	115 mph	5 - t hr
Total	555 miles	555/5 = 111 mph	5 hr

Equation 1:
d = 105 × t
Equation 2:
555 - d = 115 × (5 - t)

By substitution...
555 - (105 × t) = 115 × (5 - t)
555 - 105t = 575 -115t
10t = 575 - 555 = 20

t = 20/10 = 2 hours
Leg 2 was flown in 5 - 2 = 3 hours

3. **An executive drove from home at an average speed of 30 mph to an airport where a helicopter was waiting. The executive boarded the helicopter and flew to the corporate offices at an average speed of 60 mph. The entire distance was 150 miles; the entire trip took three hours. Find the distance from the airport to the corporate offices.**

	Distance	Rate	Time
Leg 1(drive)	d miles	30 mph	t hr
Leg 2(fly)	150 - d miles	60 mph	3 - t hr
Total	150 miles	R	3 hr

Equation 1:
d = 30t
Equation 2:
150 - 30t = 60(3 - t)
150 - 30t = 180 - 60t
30t = 30
t = 1 hour
Leg 2 Distance = 150 - d = 150 - 30t = 150 - 30(1) = 120 miles

4. **A car and a bus set out at 2 p.m. from the same point, headed in the same direction. The average speed of the car is 30 mph slower than twice the speed of the bus. In two hours, the car is 20 miles ahead of the bus. Find the rate of the car.**

	Distance	Rate	Time
Leg 1(car)	d + 20 miles	2B - 30 mph	2 hr
Leg 2(bus)	d miles	B mph	2 hr
Total	150 miles	-	2hr

Equation 1:
d = 2B
Equation 2:
d + 20 = (d - 30) × 2
d + 20 = 2d - 60
d = 80 miles
Rate car = 2B - 30 = d - 30 = 80 - 30 = 50 mph

5. **Train 1 leaves from point A toward point B 300 miles apart where train 2 leaves at the same time toward point A. If both trains leave at 2PM and Train 1 travels at 90MPH and Train 2 travels at 60MPH, then at what time do the trains pass each other**

	Distance	Rate	Time
Leg 1(Train 1)	d miles	90 mph	t hr
Leg 2(Train 2)	300 - d miles	60 mph	t hr
Total	300 miles	-	t hr

Equation 1:
d = 90t
Equation 2:
300 - d = 60t
300 - 90t = 60t
150t = 300
t = 300/150 = 2 hours The time is 2PM plus 2 hours = 4PM

6. **Train 1 leaves from point A toward point B 300 miles apart where train 2 leaves at the same time toward point A. If both trains leave at 2PM and Train 1 travels at 90MPH and Train 2 travels at 60MPH, then at what distance from point B do the trains pass each other?**

	Distance	Rate	Time
Leg 1(Train 1)	d miles	90 mph	t hr
Leg 2(Train 2)	300 - d miles	60 mph	t hr
Total	300 miles	-	t hr

Equation 1:
d = 90t
Equation 2:
300 - d = 60t
300 - 90t = 60t
150t = 300
t = 300/150 = 2 hours
Distance form point B = 300 - d = 300 - 90t = 300 - 90(2) = 120 miles

7. **A passenger train leaves the train depot 2 hours after a freight train left the same depot. The freight train is traveling 20 mph slower than the passenger train. Find the rate of each train, if the passenger train overtakes the freight train in three hours.**

	Distance	Rate	Time
Leg 1(Passenger)	d miles	r mph	5 - 2 = 3 hr
Leg 2(Freight)	d miles	r - 20 mph	5 hr
Total	d miles	-	5 hr

Equation 1:
d = r(3)
Equation 2:
d = (r - 20)5

3r = (r - 20)5
3r = 5r -100
2r = 100
r = 100/2 = 50 mph for the passenger train
r - 20 = 50 - 20 = 30 mph for the freight train

8. **Two cyclists start at the same time from opposite ends of a course that is 45 miles long. One cyclist is riding at 14 mph and the second cyclist is riding at 16 mph. How long after they begin will they meet?**

	Distance	Rate	Time
Leg 1(Train 1)	d miles	14 mph	t hr
Leg 2(Train 2)	45 - d miles	16 mph	t hr
Total	45 miles	R	t hr

Equation 1:
d = 14t
Equation 2:
45 - d = 16t
45 - 14t = 16t
30t = 45
t= 45/30 = 1.5 hours

9. **A boat travels for three hours with a current of 3 mph and then returns the same distance against the current in four hours. What is the boat's speed in calm water? How far did the boat travel one way?**

	Distance	Rate	Time
Leg 1(with current)	d miles	r + 3 mph	3 hr
Leg 2(against)	d miles	r - 3 mph	4 hr
Total	2d miles	R	7 hr

Equation 1:
$d = (r + 3) \times 3$
Equation 2:
$d = (r - 3) \times 4$

$(r + 3)3 = (r - 3)4$
$3r + 9 = 4r - 12$
$r = 9 + 12 =$ 21 mph
$d = (21 + 3)3 =$ 72 miles

10. **A spike is hammered into a train rail. You are standing at the other end of the rail. You hear the sound of the hammer strike both through the air and through the rail itself. These sounds arrive at your point six seconds apart. You know that sound travels through air at 1100 feet per second and through steel at 16,500 feet per second. How far away is that spike?**

	Distance	Rate	Time
Leg 1(Air)	d feet	1,100 fps	t + 6 sec
Leg 2(Metal)	d feet	16,500 fps	t sec
Total	-	R	-

Equation 1:
$d = 1100(t + 6)$
Equation 2:
$d = 16500t$

$1100(t + 6) = 16500t$
$1100t + 6600 = 16500t$
$15400t = 6600$
$t = 6600/15400 = 66/154 = 33/77 = 3/7$ sec.
Distance, $d = 16{,}500 \times 3/7 =$ 7,071.0 feet

KEY CONCEPTS:

Learn to setup and solve Distance = Rate × Time word problems. The approach will be useful for similar types of problems in the format A = B × C as well such as "mixture" problems and "interest" problems.

1. It is often easiest to start by recording the information provided in a table where the columns reflect the underlying equation Distance = Rate × Time and the rows reflect the different legs or phases of travel. Typically there are two legs of travel and then a "total" for 3 rows in each table.

2. Make sure all the units for distance, time, and rate have been converted to a conistent set of units. e.g. if distance given is in kilometers, but rate is in mph then conversion to the same distance units must occur whether it is miles or kilometers.

3. Idenitfy the key equations to solve given the word problem. This can vary somewhat based on the question (find combined rate? find distance? find time?) and circumstance (2 legs to a journey, two objects approaching each other, one object overtaking another etc.).

4. Solve for the desired variable and make sure to check your results.