PHYSICS
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Unit 2B
Speed and Velocity
Practice Problems TEACHER

Work each of the following problems. SHOW ALL WORK.

1. A car travels a distance of 100 km in 2 hours. What is the average speed of the car (km/h)?

$$s = \frac{d}{t} = \frac{100\,km}{2\,h} = 50\,^{km}\!/_h$$

2. An NFL wide receiver prospect runs 40 m in 4.5 seconds. What is the average speed of the wide receiver (m/s)?

$$s = \frac{d}{t} = \frac{40\,m}{4.5\,s} = 8.9\,^{m}\!/_s$$

3. The average human walks at a speed of 5 km per hour. If your PE teacher asks you to walk for 30 minutes in gym class, how far would you walk (km)?

$$s = \frac{d}{t}$$
$$5\,^{km}\!/_h = \frac{d}{0.5\,h}$$
$$(0.5\,h)(5\,^{km}\!/_h) = d$$
$$d = 2.5\,km$$

4. The posted speed limit on the road heading from your house to school is 45 mi/h, which is about 20 m/s. If you live 8 km (8,000 m) from school, how long will it take you to get to school if there is no traffic? Convert your answer to minutes.

$$s = \frac{d}{t}$$
$$20\,^{m}\!/_s = \frac{8\,000\,m}{t}$$
$$(t)\,20\,^{m}\!/_s = 8\,000\,m$$
$$t = 400\,s$$
$$\frac{400\,s}{1}\left(\frac{1\,min}{60\,s}\right) = \frac{400\,min}{60} = 6.67\,min$$

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5. A ladybug walks 10 cm forward then 5 cm backward in 20 seconds. What is the average speed of the ladybug?

$$s = \frac{d}{t} = \frac{15\,cm}{20\,s} = 0.75\ ^{cm}/_s$$

6. Using the information from the previous question, what is the average velocity of the ladybug?

$$v = \frac{\Delta x}{t} = \frac{5\,cm}{20\,s} = 0.25\ ^{cm}/_s$$

7. A city bus travels 6 blocks east and 8 blocks north. Each block is 100 m long. If the bus travels this distance in 15 minutes, what is the average speed of the bus (m/s)?

$$s = \frac{d}{t} = \frac{1400\,m}{900\,s} = 1.56\ ^{m}/_s$$

8. Using the information from the previous question, what is the average velocity of the city bus?

$$R = \sqrt{(\Sigma x)^2 + (\Sigma y)^2}$$
$$R = \sqrt{(600\,m)^2 + (800\,m)^2}$$
$$R = \sqrt{360\,000\,m^2 + 640\,000\,m^2}$$
$$R = \sqrt{1\,000\,000\,m^2}$$
$$R = 1000\,m$$
$$v = \frac{\Delta x}{t} = \frac{1000\,m}{900\,s} = 1.11\ ^{m}/_s$$

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Work each of the following problems. SHOW ALL WORK.

9. A jogger runs 6 km north, 5 km east, then another 4 km north. Her average speed 8 km/h. How long will it take her to complete her run?

The total distance traveled by the jogger is 15 km.

$$8 \, ^{km}/_h = \frac{15 \, km}{t}$$
$$8 \, ^{km}/_h (t) = 15 \, km$$
$$t = 1.88 \, h$$

10. Using the information from the previous question, what is her average velocity during this time?

The total displacement must be determined in order to find the average velocity.

Vector	x-component	y-component
1	0 km	6 km
2	5 km	0 km
3	0 km	4 km
Total	5 km	10 km

$$R = \sqrt{(\Sigma x)^2 + (\Sigma y)^2}$$
$$R = \sqrt{(5 \, km)^2 + (10 \, m)^2}$$
$$R = \sqrt{25 \, km^2 + 100 \, km^2}$$
$$R = \sqrt{125 \, km^2}$$
$$R = 11.2 \, km$$
$$v = \frac{\Delta x}{t} = \frac{11.2 \, km}{1.88 \, h} = 5.96 \, ^{km}/_h$$