1. Which of these is a **vector** quantity?

   ☐ temperature

   ☐ velocity

   ☐ mass

   ☐ speed

2. A runner completes exactly one lap of a 400 m track. What is their **displacement**?

   ☐ 800 m

   ☐ 0 m

   ☐ 200 m

   ☐ 400 m

3. On a **position–time** graph, what does the slope of the line represent?

   ☐ displacement

   ☐ acceleration

   ☐ distance

   ☐ velocity

4. A passenger walks at $+2\ \frac{\text{m}}{\text{s}}$ toward the front of a train moving at $+30\ \frac{\text{m}}{\text{s}}$. What is the passenger's velocity relative to the ground, in $\frac{\text{m}}{\text{s}}$?

   _____ m/s

5. A velocity of $10\ \frac{\text{m}}{\text{s}}$ points 37° above the horizontal. Its horizontal component is $10\cos 37^\circ$. With $\cos 37^\circ = 0.8$, what is v_x in $\frac{\text{m}}{\text{s}}$?

   _____ m/s

6. A velocity of $-8\ \frac{\text{m}}{\text{s}}$ is slower than a velocity of $+8\ \frac{\text{m}}{\text{s}}$.

   ☐ True ☐ False

7. A cyclist has a displacement of 240 m in 30 s. What is the average velocity, in $\frac{\text{m}}{\text{s}}$?

   _____ m/s

8. On a **velocity–time** graph, what does the area between the line and the time axis represent?

   ☐ velocity

   ☐ acceleration

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   ☐ force

9. The same passenger now walks toward the **back** at $2\ \frac{\text{m}}{\text{s}}$. Velocity relative to the ground, in $\frac{\text{m}}{\text{s}}$?

   _____ m/s

10. For the same velocity, the vertical component is $10\sin 37^\circ$. With $\sin 37^\circ = 0.6$, what is v_y in $\frac{\text{m}}{\text{s}}$?

    _____ m/s

1. **velocity**

   Velocity has a size **and** a direction, so it is a vector. Mass, temperature and speed are scalars (size only).

2. **0 m**

   Displacement is the change in position. The runner ends where they started, so $\Delta x = 0$. The **distance** travelled is 400 m.

3. **velocity**

   Slope is rise over run $= \Delta x / \Delta t$, which is the **velocity**.

4. **32 m/s**

   Same line, same direction: $30 + 2 = 32\ \frac{\text{m}}{\text{s}}$.

5. **8 m/s**

   $v_x = A\cos\theta = 10 \times 0.8 = 8\ \frac{\text{m}}{\text{s}}$.

6. **False**

   Both have the same **speed** ($8\ \frac{\text{m}}{\text{s}}$). The minus sign is a direction, not a smaller size.

7. **8 m/s**

   $v_{\text{avg}} = \dfrac{\Delta x}{\Delta t} = \dfrac{240}{30} = 8\ \frac{\text{m}}{\text{s}}$.

8. **displacement**

   Area = velocity $\times$ time $= \Delta x$, the **displacement**.

9. **28 m/s**

   Now the walk is negative: $30 + (-2) = 28\ \frac{\text{m}}{\text{s}}$.

10. **6 m/s**

    $v_y = A\sin\theta = 10 \times 0.6 = 6\ \frac{\text{m}}{\text{s}}$.

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