4 Motion - velocity and acceleration – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	**中文**	**Write it 3 times** (English)
velocity	速度	
acceleration	加速度	

Recall

The derivative is a rate of change – and motion is all about rates:

- Velocity is how fast your position changes.
- Acceleration is how fast your velocity changes.
- Calculus connects all three.

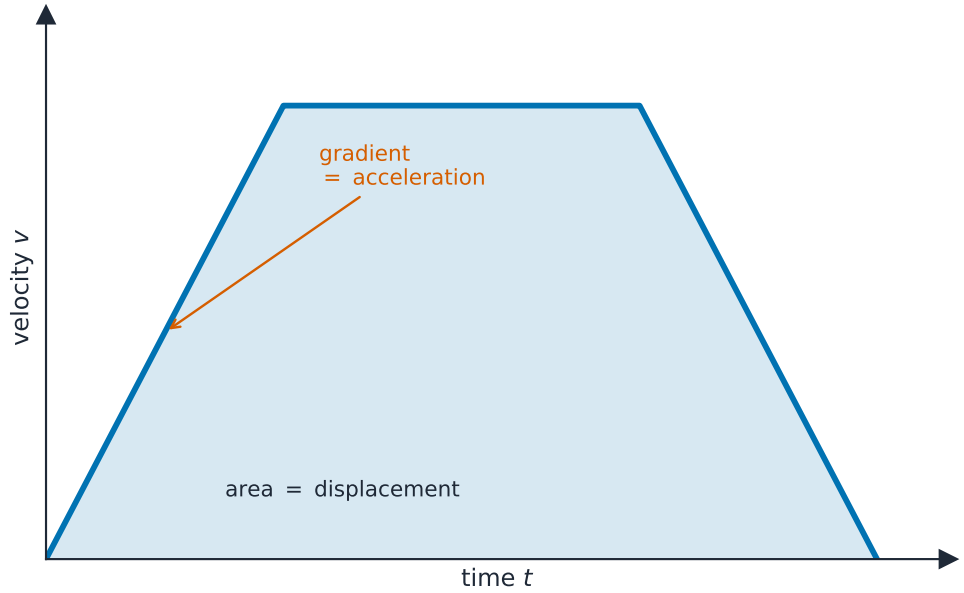
This sheet lines up motion with derivatives. Each idea has a worked example.

New ideas

■ 1 Position, velocity, acceleration

For an object moving along a line:

- **velocity** 速度 is the derivative of position (how fast position changes),
- **acceleration** 加速度 is the derivative of velocity (how fast velocity changes).



2 From position to velocity

Worked example. If position is $s(t) = t^2$, then velocity is $s'(t) = 2t$. At $t = 3$ the velocity is $2 \times 3 = 6$.

3 From velocity to acceleration

Worked example. With velocity $v(t) = 2t$, the acceleration is $v'(t) = 2$ – a constant.

4 Direction from the sign

A **positive** velocity means moving in the positive direction; a **negative** velocity means moving the other way. The object is momentarily at rest when velocity is 0.

Watch out: velocity is the derivative of **position**, and acceleration is the derivative of **velocity** – so acceleration is the derivative of position **twice** (the second derivative).

Practice

Try these in order. The methods are all above.

2.1 State how velocity is related to position, and how acceleration is related to velocity. [2]

2.2 Position is $s(t) = t^2$. Find the velocity $s'(t)$. [2]

2.3 Using that velocity, find the velocity at $t = 5$. [2]

2.4 For velocity $v(t) = 3t$, find the acceleration. [2]

2.5 State what a velocity of 0 tells you about the object's motion. [1]