A Level Mathematics

Chapter 8 - Mechanics

Further Kinematics

Chapter Overview

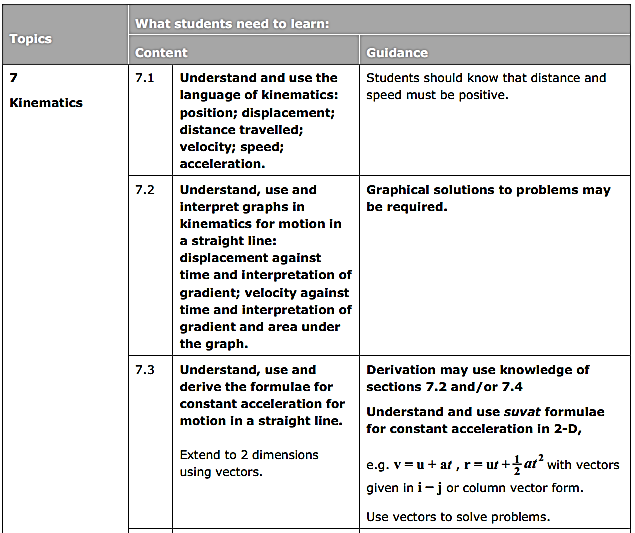
1. Vectors in Kinematics

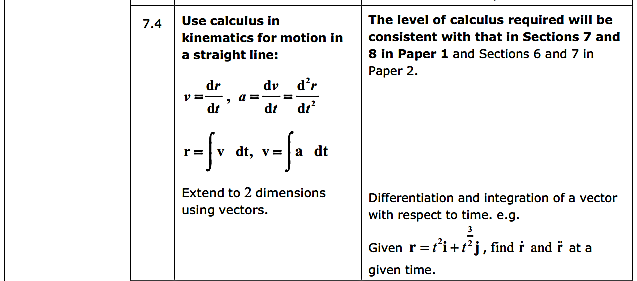
2. Vector Methods with Projectiles

3. Variable Acceleration in One Dimension

4. Differentiating Vectors

5. Integrating Vectors





1. **Vectors in Kinematics**

If a particle starts from the point with position vector ***r***0, and moves with constant velocity ***v***, its displacement from its initial position at time t is given by ***v***t and it position vector ***r*** is given by:

**Example**

At time , where is the time (in seconds), a particle is at the point with position vector m and travels with velocity ms-1. Find:

a) The position vector of the particle after seconds

b) The distance the particle is from the origin, O, after 3 seconds.

**Example**

A particle starts at a point 8m from O at an angle of 45O anti-clockwise from east and travels with a velocity ms-1, where and are unit vectors due east and north respectively.

Find the position vector of the particle after t seconds in the form .

**Example – Using SUVAT with Vectors**

A particle is initially travelling with velocity ms-1 and 2 seconds later it has a velocity of ms-1, where and are unit vectors in the directions of the positive x- and y- axes respectively. Given that the acceleration of the particle is constant, find:

a) The acceleration

b) The magnitude of the acceleration

c) The angle that the acceleration makes with the vector

**Example** *(Textbook p161 Example 3)*

An ice skater is skating on a large flat ice rink. At time the skater is at a fixed point and is travelling with velocity ms-1.

At time s the skater is travelling with velocity ms-1.

Relative to , the skater has position vector at time seconds.

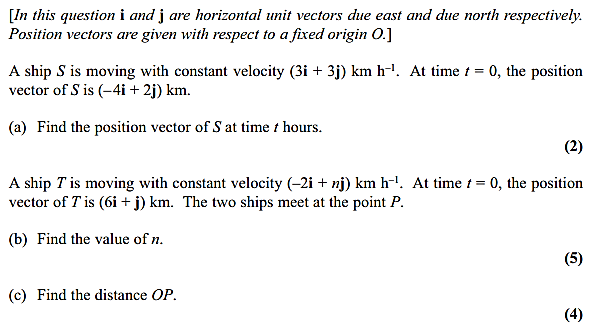
Modelling the ice skater as a particle with constant acceleration, find:

1. The acceleration of the ice skater
2. An expression for in terms of
3. The time at which the skater is directly north-east of .

A second skater travels so that she has position vector m relative to at time .

1. Show that the two skaters will meet.

**Test Your Understanding** *(EdExcel M1 May 2013(R) Q6)*



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