Use of Mathematics (Pilot)   USE1/PM

Algebra

Preliminary Material

Data Sheet

**To be opened and issued to candidates between
Monday 27 April 2015 and Monday 11 May 2015**

REMINDER TO CANDIDATES

YOU MUST **NOT** BRING THIS DATA SHEET
WITH YOU WHEN YOU SIT THE EXAMINATION.
A CLEAN COPY WILL BE MADE AVAILABLE.

INFORMATION

The Preliminary Material is to be seen by teachers and candidates **only**, for use during preparation for the examination on Monday 18 May 2015. It **cannot** be used by anyone else for any other purpose, other than as stated in the instructions issued, until after the examination date has passed. It must **not** be provided to third parties.

Boyle's Law

Boyle's Law states that, if the temperature of a fixed mass of gas remains constant, the volume of the gas is inversely proportional to the pressure on the gas.

This means that the relationship between the volume, V, and the pressure, P, can be modelled by an equation of the form

$$V = \frac{k}{P}$$

where k is a constant.

The diagram shows gas molecules in a cylinder. A piston exerts pressure on the gas, and this pressure can vary.
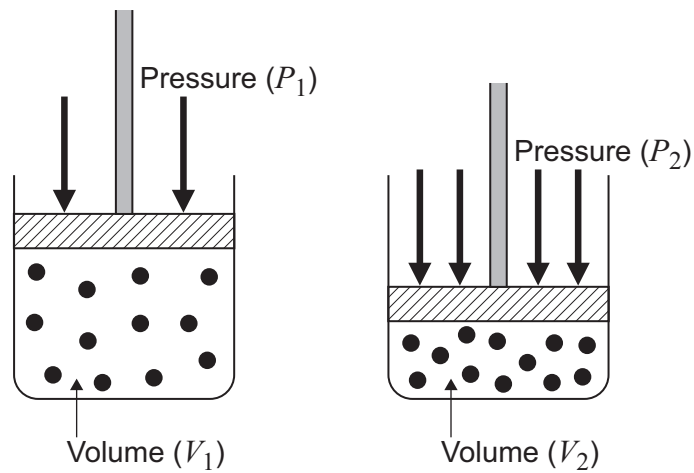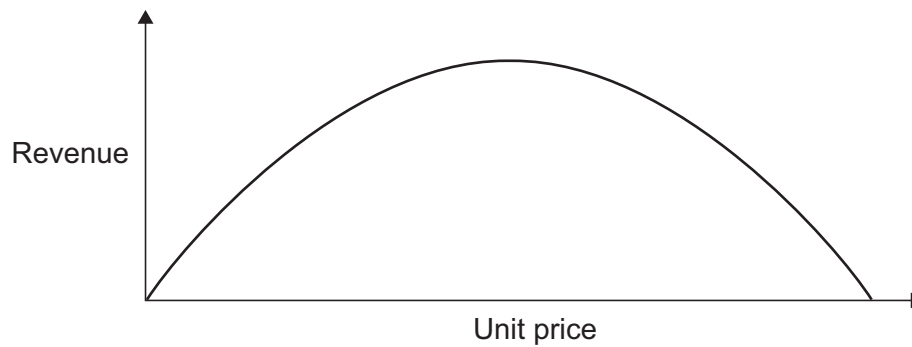
Revenue

The revenue from a product is the amount of money received from the sale of the product.

Revenue is not the same as profit, as revenue does not take material and production costs into account.

A very simple model relating revenue to unit price is shown here. Unit price is the price of one item.

The model assumes that:

- when the unit price is low, the amount of revenue is low
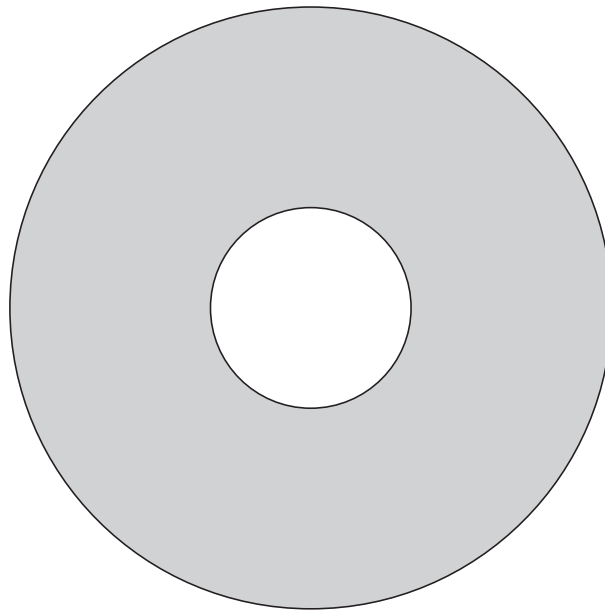- when the unit price is high, fewer people buy the item, so the revenue is again low.

Turn over

Ornaments

Martin, an artisan, is making a range of ornaments, based on the sculpture shown above.

He starts off by pressing the following shape out of thin metal.

He then cuts a series of concentric circles which divide the shape into rings.
The circles are not cut all the way round. Each pair of rings remains connected at two opposite locations.

The places where the rings remain joined are called tabs. These tabs have differing widths.
The diagram below shows a simplified version of the shape after the circles have been cut.

Key

w Tab width

r Distance from tab to the centre
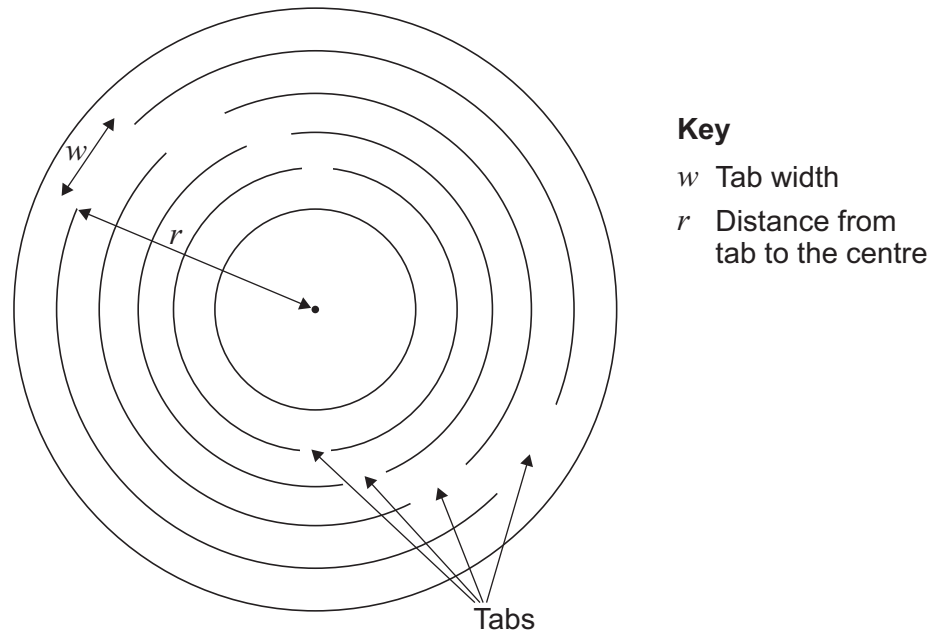
Tabs

After the shape has been cut, the connected rings will be twisted to make the shape 3-dimensional.
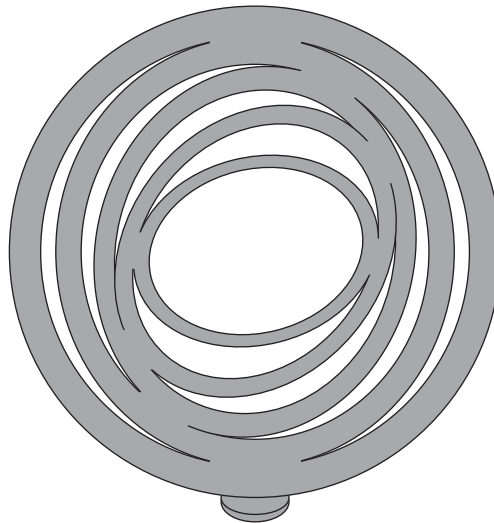
Martin has to decide how wide to make the tabs so that they are flexible enough, without the ornament being too fragile.

He decides that the width of the tab needs to increase as the distance from the tab to the centre of the ornament increases.

Turn over ▶

Big wheel

The height above ground level of a person riding on the big wheel at a fairground varies over time.

If the wheel is rotating at a constant speed, the person's height above the ground can be modelled by a trigonometric function.

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