GCSE Maths – Ratio, Proportion and Rates of Change

Interpreting Gradients (Higher Only)

Worksheet

NOTES

SOLUTIONS

Section A

Worked Example

Depreciation of car value
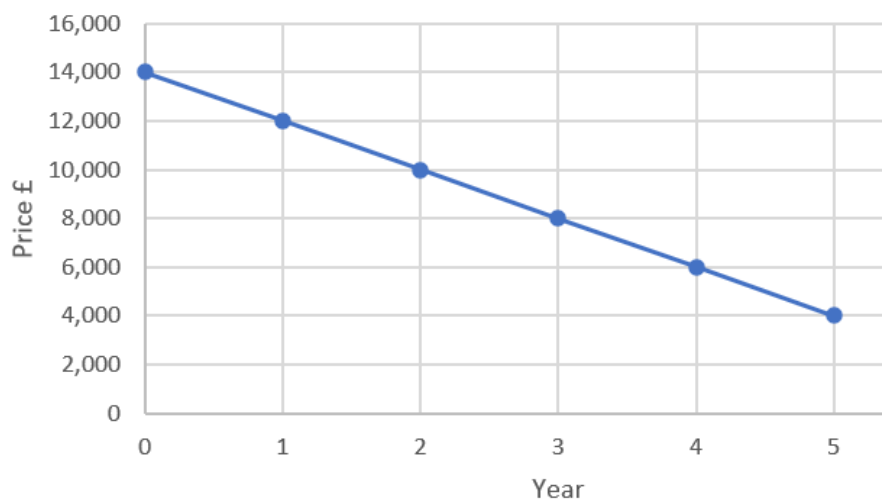
Calculate the rate of change between the price of the car and the year.

Step 1: Find two co-ordinates' points on this graph.

$$(x_1, y_1) = (0,14000)$$
$$(x_2, y_2) = (5,4000)$$

Step 2: Calculate the gradient using the formula $m = \frac{y_1 - y_2}{x_1 - x_2}$.

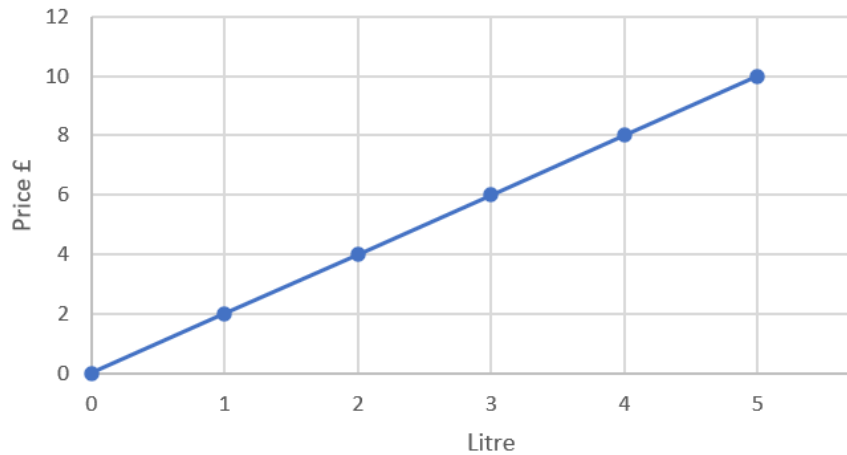$$m = \frac{14000 - 4000}{0 - 5}$$

$$m = \frac{10,000}{-5} = -2000$$

Step 3: Form a conclusion.

The rate of change between the car value and year is -2000. The car depreciates **£2000** every year.

Guided Example

Price of oil per litre

Calculate the rate of change between the price of oil and litre (cost per litre).

Step 1: Find two co-ordinates' points on this graph.

Step 2: Calculate the gradient using the formula $m = \frac{y_1 - y_2}{x_1 - x_2}$.
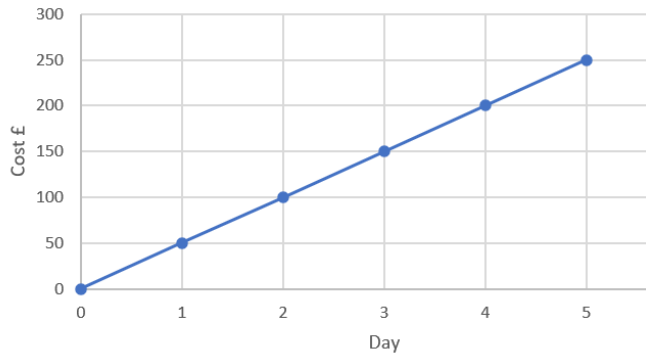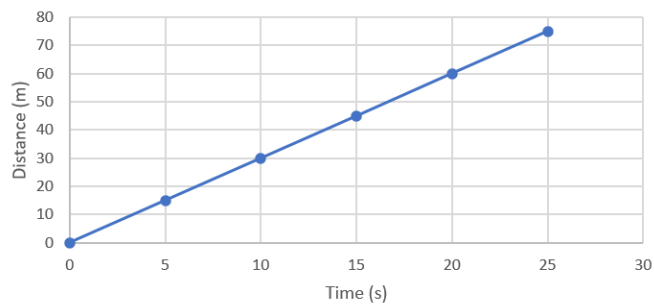
Step 3: Form a conclusion.

1. Calculate the cost per day for renting a hotel room.
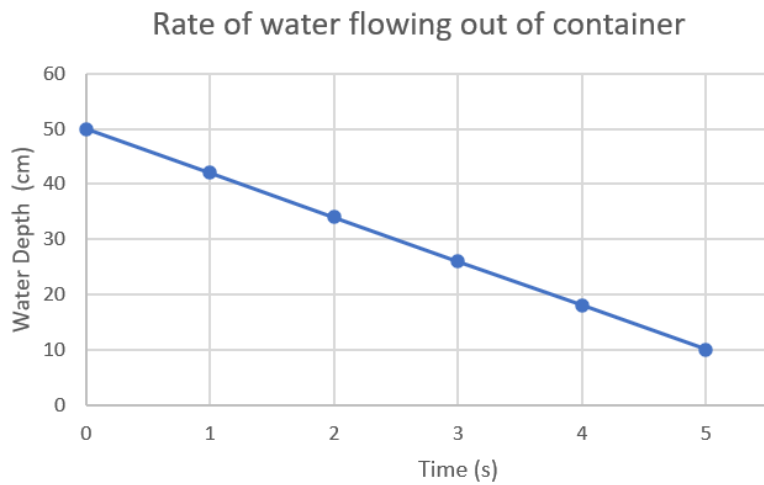
Cost of renting a hotel room

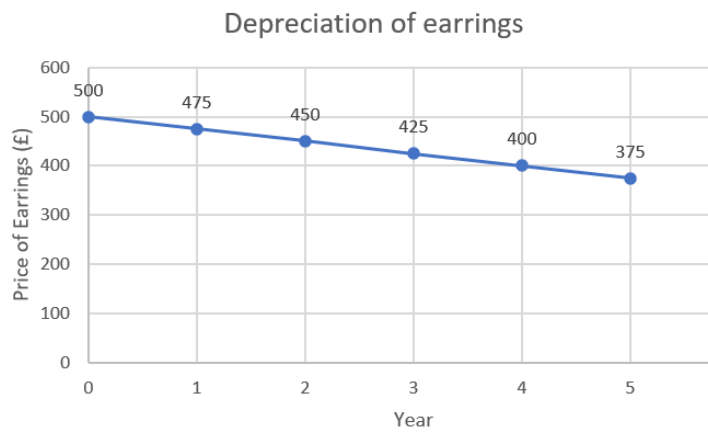2. Calculate the rate of change between the distance and time (speed).

The relationship between the distance and time of a toy car
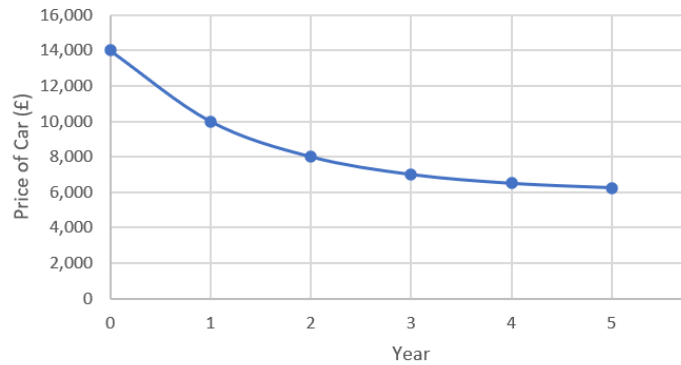
3. Calculate the rate of water discharge.

Rate of water flowing out of container

4. Calculate the rate of depreciation of the antique earrings.

Depreciation of earrings
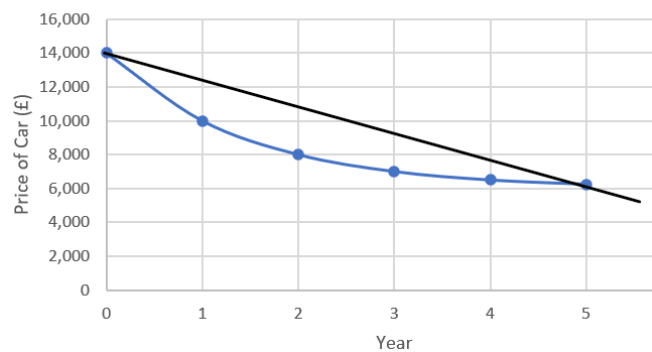
Worked Example

Depreciation of car value

Estimate the average rate of change between the car value and year.

Step 1: Draw a chord using a ruler and pencil, connecting the starting and ending point.

Depreciation of car value

Step 2: Find two co-ordinates' points on this chord:

$$(x_1, y_1) = (0, 14000)$$
$$(x_2, y_2) = (5, 6250)$$

Step 3: Calculate the gradient using the formula $m = \dfrac{y_1 - y_2}{x_1 - x_2}$.

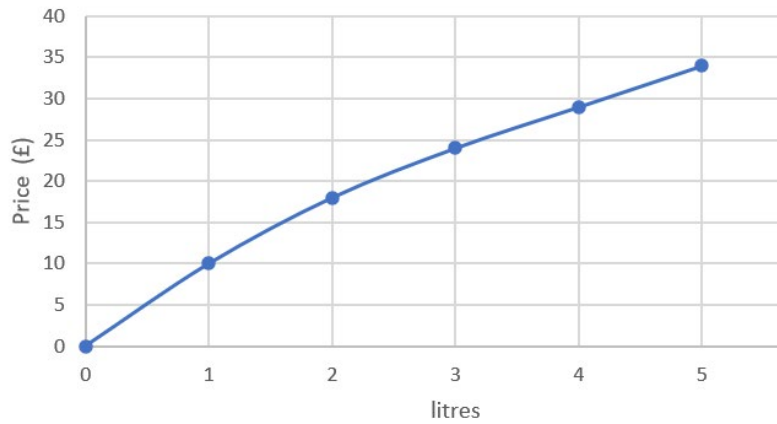$$m = \frac{14000 - 6250}{0 - 5} = \frac{7750}{-5} = -1550$$

Step 4: Form a conclusion.

The estimate of the rate of change between the car value and year is -1550. *The car depreciates £1550 every year approximately.*
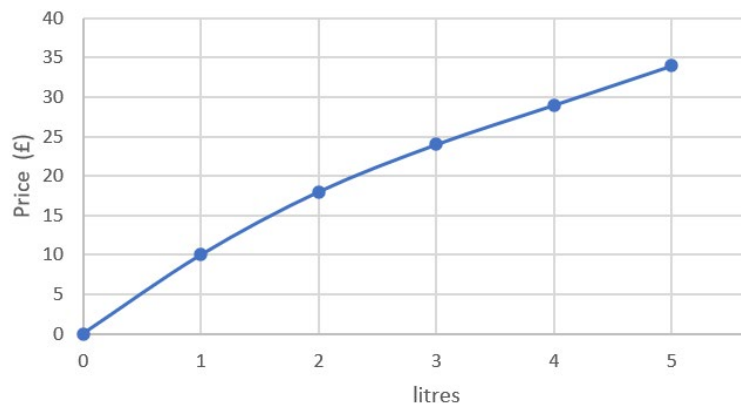
Guided Example

Cost of oil per litre

Estimate the cost of oil per litre.

Step 1: Draw a chord using a ruler and pencil, connecting the starting and ending point.

Cost of oil per litre
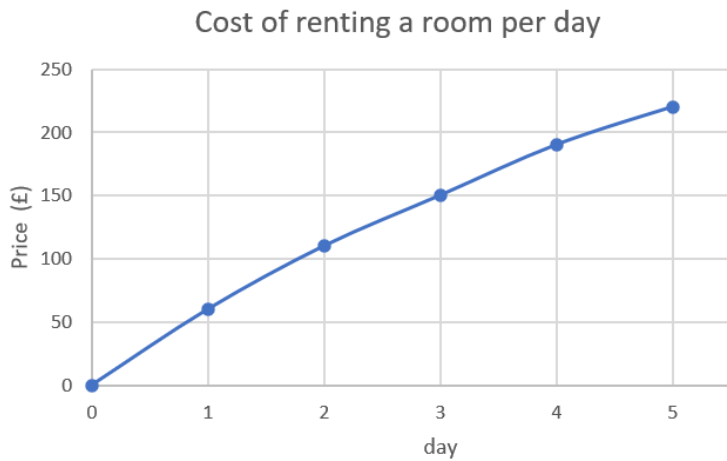

Step 2: Find two co-ordinates' points on this chord.

Step 3: Calculate the gradient using the formula $m = \frac{y_1 - y_2}{x_1 - x_2}$.
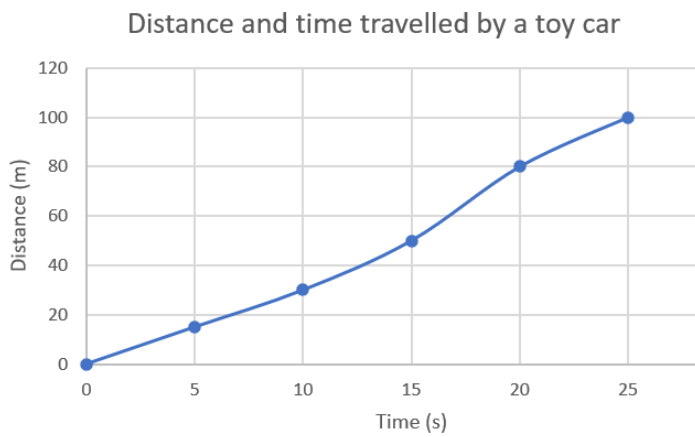
Step 4: Form a conclusion.

5. Estimate the cost per day for renting a hotel room.

Cost of renting a room per day

6. Estimate the rate of change between the distance and time (speed)

Distance and time travelled by a toy car

7. Estimate the rate of water discharge.

Rate of water flowing out of container
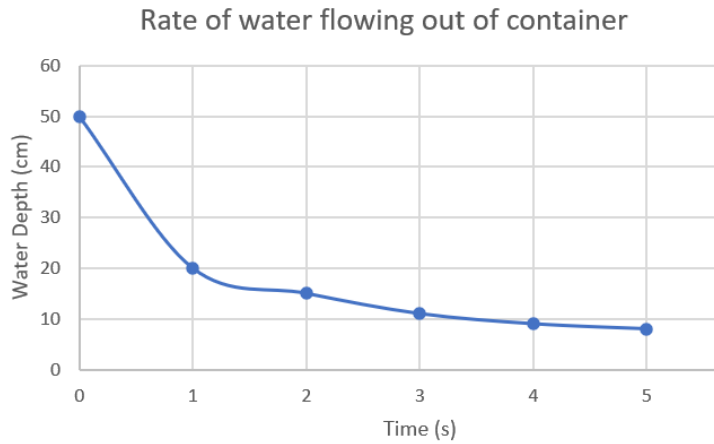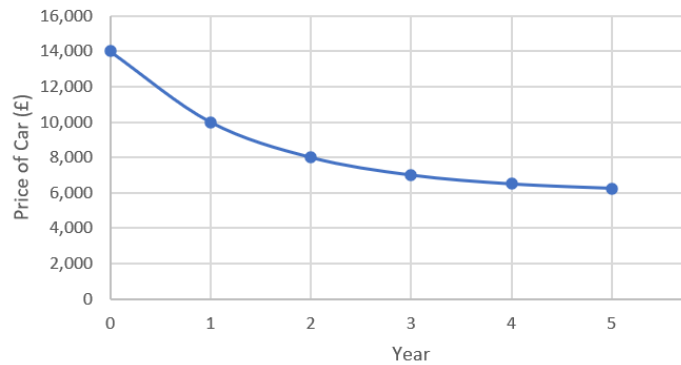

8. Estimate the depreciation of the antique earrings

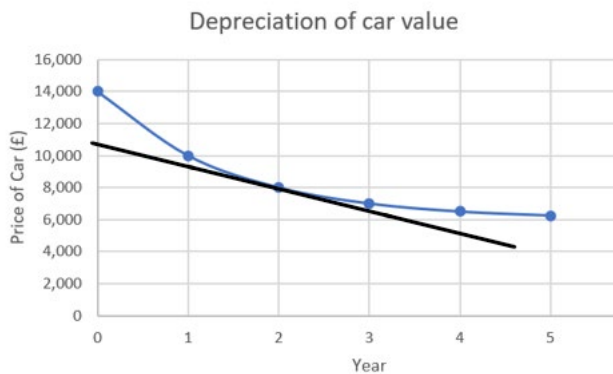**Depreciation of earrings**
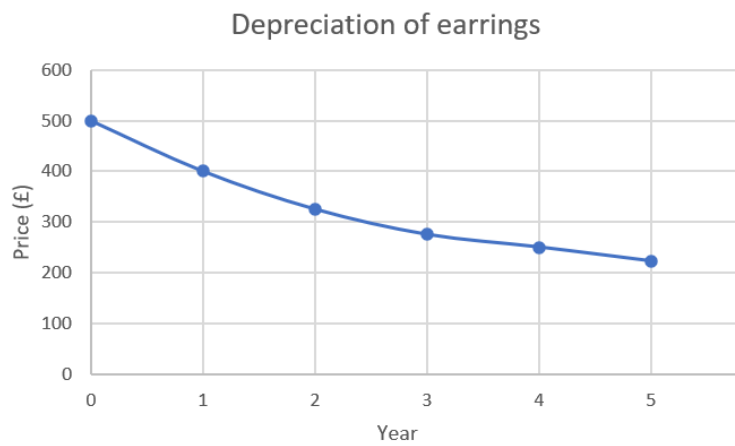
Section C

Worked Example

Depreciation of car value

Estimate the rate of change between the car value and year in year 2.

Step 1: Draw a tangent using a ruler and pencil at year 2.

Depreciation of car value

Step 2: Find two co-ordinates' points on this tangent:

$$(x_1, y_1) = (1, 9500)$$
$$(x_2, y_2) = (2, 8000)$$

Step 3: Calculate the gradient using the formula $m = \dfrac{y_1 - y_2}{x_1 - x_2}$.
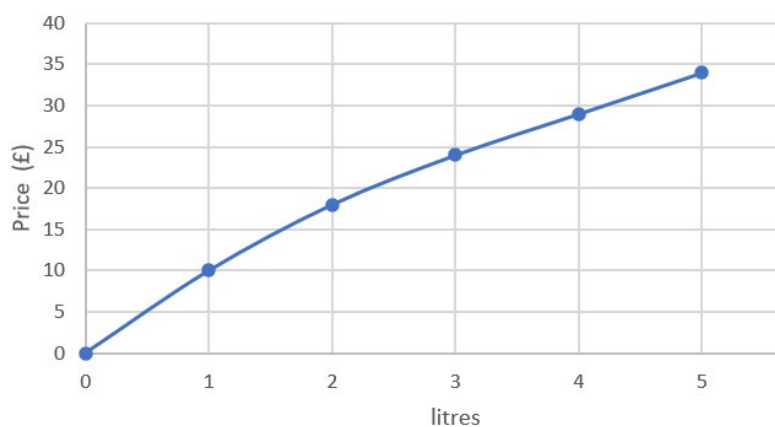
$$m = \frac{9500 - 8000}{1 - 2} = \frac{1500}{-1} = -1500$$

Step 4: Form a conclusion.

At year 2, the depreciation of the car is approximately **£1500** per year.
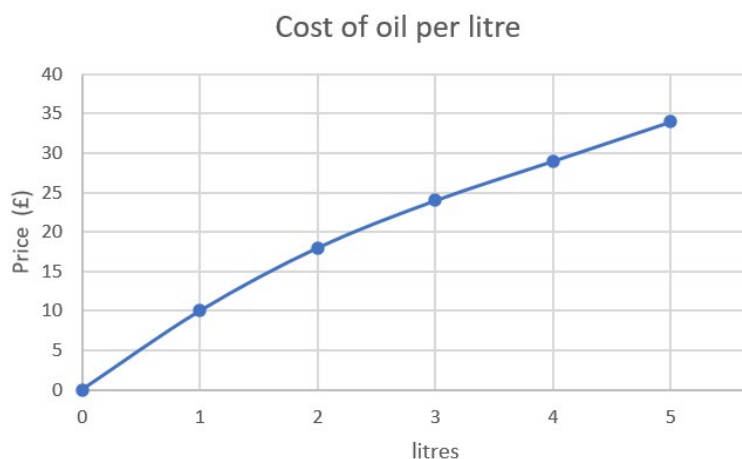
Guided Example

Cost of oil per litre

Estimate the cost of oil per litre when there are 2 litres of oil.

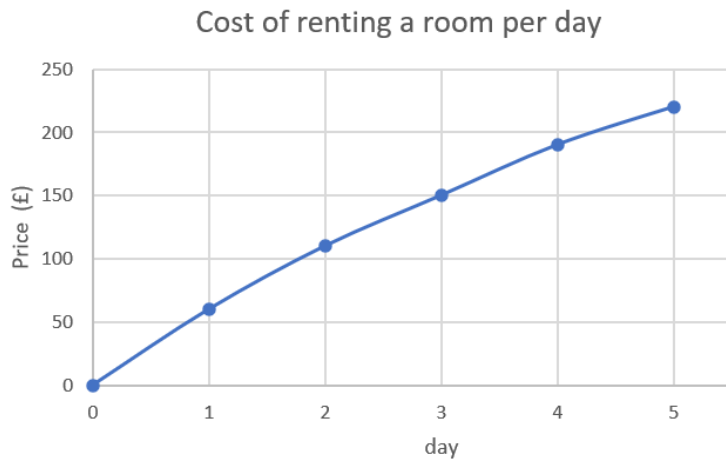**Step 1**: Draw a tangent using a ruler and pencil at litre 2.

Cost of oil per litre

Step 2: Find two co-ordinates' points on this tangent.

Step 3: Calculate the gradient using the formula $m = \frac{y_1 - y_2}{x_1 - x_2}$.
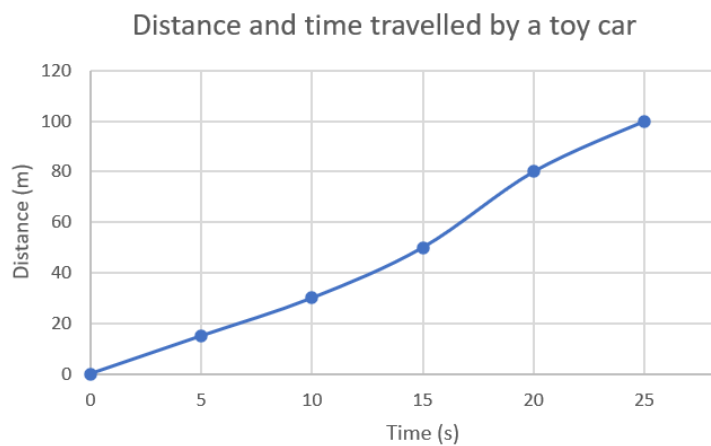
9. Estimate the cost per day for renting a hotel room on day 3.

Cost of renting a room per day

10. Estimate the speed at 15 seconds.

Distance and time travelled by a toy car

11. Estimate the rate of water discharge at 4 seconds.

Rate of water flowing out of container
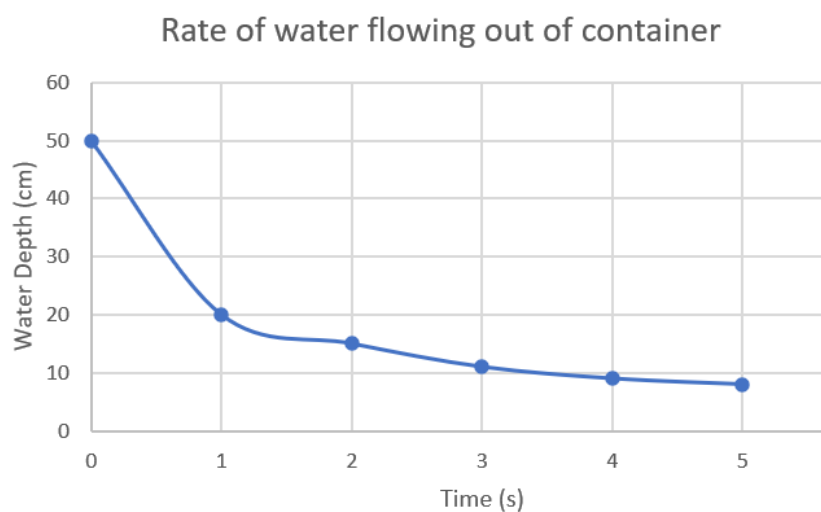
12. Estimate the rate of depreciation of the antique earrings in Year 3.

Depreciation of earrings