SUBJECT: Maths

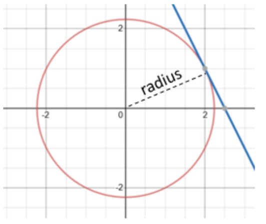
UNIT: Year 11 Graphs

Key Concept

A **tangent** touches a circle at **one point**.
A **tangent** line is **perpendicular** to the **radius** of the circle.
The gradient of the tangent is the **negative reciprocal** of the gradient of the equation of the line of the radius.

Key Words

Velocity: another word for speed. Plotted against time means v x t = d
Trapezium: the shapes created under a curve in order to find the area



Find the equation of the tangent to the circle with equation:

$$x^2 + y^2 = 5$$

which passes through the point (2,1).

Examples

1) Find the equation of the line which is the radius of the circle.

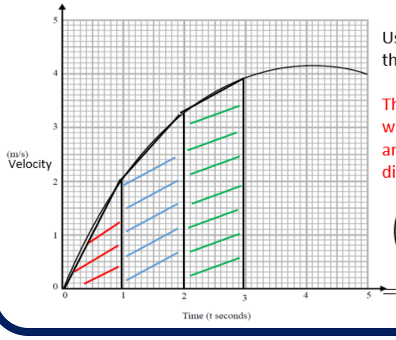
$$gradient = \frac{1}{2} \quad therefore\ y = \frac{1}{2}x$$

2) The tangent is perpendicular to the radius.

$$gradient\ of\ tangent = negative\ reciprocal\ of\ \frac{1}{2}$$
$$= -2$$

3) Substitute in the given coordinate (2,1) to $y = -2x + c$

$$y = -2x + c$$
$$1 = (-2 \times 2) + c$$
$$1 + 4 = c$$
$$5 = c$$
$$y = -2x + 5$$



Examples

Use 3 strips of equal width to find an estimate of the distance travelled in the first 3 seconds.

The strips will either be triangles or trapeziums. You will calculate the area of each section separately and combine the answers for the complete distance.

$$\left(\frac{1 \times 2}{2}\right) + \left(\frac{(2 + 3.2) \times 1}{2}\right) + \left(\frac{(3.2 + 3.9) \times 1}{2}\right)$$

$$= 7.15m$$

Key Concept

A **velocity-time** graph (or speed-time graph) is a way of visually expressing a journey. With speed or velocity on the *y*-axis and time on the *x*-axis.

A velocity-time graph tells us **how someone's speed has changed over a period of time**.

The **distance** completed in the journey can be calculated from the **area underneath the curve**.

SUBJECT: Maths

UNIT: Year 11 Algebraic Proof

Key Concept

When proving algebraically, your answer must include expressions ready to substitute **any** number. NOT one or two examples.

Key Words

Consecutive: one after another. Consecutive numbers =n, n+1, n+2 Consecutive multiples of 4 = 4n, 4n+4, 4n+8.
Even: Even is divisible by 2, 2 can be factorised out. 2(x)

Examples

Prove:

$$(\boldsymbol{n+4})^2 - (\boldsymbol{n+2})^2$$

is always a multiple of 4 for all positive integers of n.

$$(\boldsymbol{n+4})^2 - (\boldsymbol{n+2})^2$$

Expand Expand

$$(\boldsymbol{n^2 + 8n + 16}) - (\boldsymbol{n^2 + 4n + 4})$$

Simplify Simplify

$$\boldsymbol{4n + 12}$$

Factorise Factorise

$$\boldsymbol{4(n+3)}$$

Because 4 is a factor of all terms in this expression, then the original expression must always be a multiple of 4.

Prove that the sum of any three consecutive even numbers is always a multiple of 6:

Term 1: $2n$
Term 2: $2n + 2$
Term 3: $2n + 4$

$$\boldsymbol{2n + 2n + 2 + 2n + 4}$$

Simplify Simplify

$$\boldsymbol{6n + 6}$$

Factorise Factorise

$$\boldsymbol{6(n+1)}$$

6 is a factor of all terms therefore the original expression must always be a multiple of 6.

Prove that the product of two odd numbers is always odd:

Term 1: $2n$+1
Term 2: $2n + 3$

$$\boldsymbol{(2n+1)(2n+3)}$$

Expand Expand

$$\boldsymbol{4n^2 + 8n + 3}$$

Factorise Factorise

$$\boldsymbol{4n(n+2) + 3}$$

This term is even as any multiple of 4 is even.

This term is odd as 3 is an odd number.

Even + Odd = Odd number