1 Pure Mathematics 1 – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	**Write it 3 times** (English)		
gradient			
parallel			
perpendicular			
circle			
centre			
radius			
tangent			

Recall

In **Part 1** you completed the square and used the discriminant. Also bring your IGCSE work:

- you found the **gradient** of a line and used $y = mx + c$;
- you plotted points (x, y) on axes.

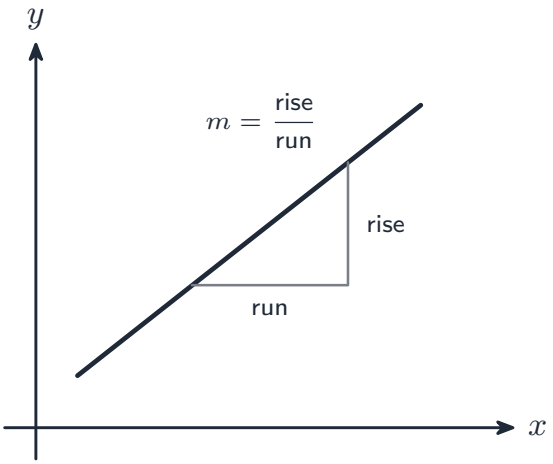
Part 2 sharpens straight lines (parallel and perpendicular) and adds the equation of a **circle**.

New ideas

1 Straight lines

The **gradient** (steepness) of the line joining (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1}.$$



Two lines are **parallel** when their gradients are **equal**, and **perpendicular** (at right angles) when the product of their gradients is -1.

Worked example. A line has gradient 2. A line perpendicular to it has gradient $-\frac{1}{2}$ (because $2 \times -\frac{1}{2} = -1$).

Micro-check. A line has gradient 3. State the gradient of a line **perpendicular** to it. [1]

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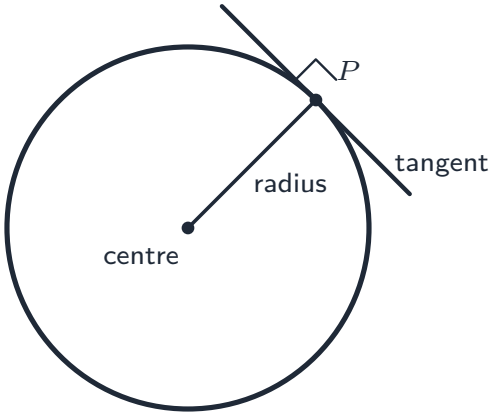
2 Circles

A **circle** with **centre** (a, b) and **radius** r has the equation

$$(x - a)^2 + (y - b)^2 = r^2.$$

A **tangent** touches the circle at one point and is **perpendicular** to the radius drawn to that point.

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Worked example. A circle with centre $(1, 2)$ and radius 3 has equation $(x-1)^2+(y-2)^2=9$.

Micro-check. Write the equation of the circle with centre $(0, 0)$ and radius 5. [1]

Watch out: parallel lines have *equal* gradients; perpendicular lines have gradients whose *product* is -1 (so m and $-1/m$). For $(x-a)^2+(y-b)^2=r^2$ the centre is (a, b) – note the *sign flips* – and the radius is r, not r^2.

Practice

1.1 Find the gradient of the line joining $(1, 2)$ and $(5, 10)$. [2]

1.2 A line has gradient $\frac{1}{2}$. State the gradient of a line (a) parallel to it, (b) perpendicular to it. [2]

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1.3 Write the equation of the circle with centre $(3, -1)$ and radius 4. [2]

1.4 State the centre and radius of the circle $(x-2)^2 + (y+5)^2 = 49$. [2]

1.5 A circle has centre $(4, 6)$ and passes through the origin $(0, 0)$. Find its radius. [2]

1.6 Challenge. Find the equation of the line through $(2, 3)$ that is perpendicular to $y = 2x + 1$. [3]

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