

1 Pure Mathematics 1 – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)		
gradient	斜率	_____	_____	_____
parallel	平行	_____	_____	_____
perpendicular	垂直	_____	_____	_____
circle	圆	_____	_____	_____
centre	圆心	_____	_____	_____
radius	半径	_____	_____	_____
tangent	切线	_____	_____	_____

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.

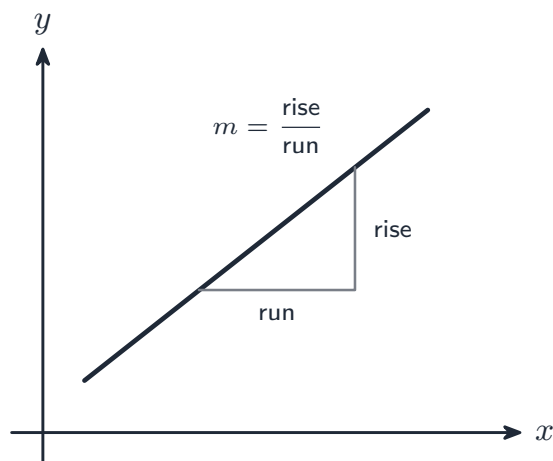
Part 2 sharpens straight lines (parallel and perpendicular) and adds the equation of a **circle**.

New ideas

■ 1 Straight lines

The **gradient** 斜率 (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** 平行 when their gradients are **equal**, and **perpendicular** 垂直 (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 $2 \times -\frac{1}{2} = -1$).

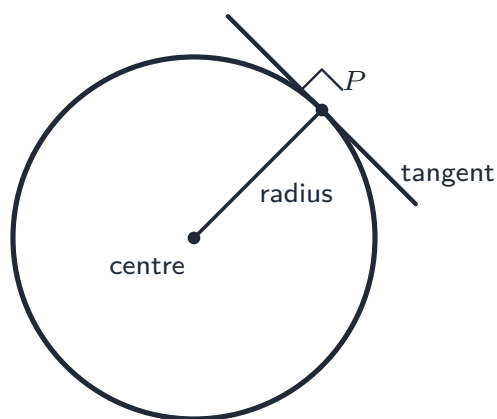
Micro-check. A line has gradient 3. State the gradient of a line **perpendicular** to it. [1]

■ 2 Circles

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

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

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



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]

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]