Name _____ Date _____

Unit 11 · Graphs — teaching slides

18 slides, formatted for printing.

11.1 Coordinates

Reading a coordinate pair

- Coordinates come in a fixed order: **(x, y)**.
- x first: how far across from the origin.
- y second: how far up or down.
- “Along the hall, then up the stairs” is the phrase that sticks.

```
(3, 2) 3 across, 2 up
(3, −2) 3 across, 2 down
(3, 5) and (5, 3) are different points
```

The origin and the axes

- The **origin** is (0, 0), where the axes cross.
- Everything is measured from there.
- A point with x = 0 sits on the y-axis.
- A point with y = 0 sits on the x-axis.

```
(0, 4) on the y-axis
(−3, 0) on the x-axis
(0, 0) the origin itself
```

The four quadrants

- The axes cut the plane into four regions.
- They are numbered **anticlockwise**, starting top right.
- The signs of x and y tell you which one you are in.
- Knowing the signs is quicker than counting squares.

```
1 (+, +) top right
2 (−, +) top left
3 (−, −) bottom left
4 (+, −) bottom right
```

Lines through pairs of points

- Same y-coordinate → the line is horizontal.
- Same x-coordinate → the line is vertical.
- Spotting this makes distances trivial to work out.
- Otherwise the line is a slope, and Unit 11.2 handles those.

```
(1, 2) and (5, 2) → horizontal
(3, 1) and (3, 6) → vertical
```

Distance along a line

- On a horizontal line, subtract the x-coordinates.
- On a vertical line, subtract the y-coordinates.
- Take the larger minus the smaller, so the answer is positive.
- Careful with negatives: 6 − (−4) is 10, not 2.

```
(−4, 2) to (6, 2)
6 − (−4) = 10
ten squares apart
```

The midpoint

- Halfway between two points.
- Average the two x-coordinates.
- Average the two y-coordinates.
- The two averages together give the midpoint.

```
(1, 1) and (5, 5)
x: (1 + 5) ÷ 2 = 3
y: (1 + 5) ÷ 2 = 3
midpoint (3, 3)
```

11.2 Straight-line graphs

A rule makes a line

- Choose some values of x.
- Work out y for each one using the rule.
- Plot the pairs as coordinates.
- For a rule like y = 2x + 1, the points always fall in a straight line.

```
y = 2x + 1
x: 0 1 2 3
y: 1 3 5 7
plot (0,1) (1,3) (2,5) (3,7)
```

The gradient

- The number in front of x tells you the steepness.
- It is how much y changes when x goes up by 1.
- A bigger number means a steeper line.
- A negative number means the line goes downhill.

```
y = x up 1 for each 1 across
y = 3x up 3 for each 1 across — steeper
y = −2x down 2 for each 1 across
```

The y-intercept

- The constant tells you where the line crosses the y-axis.
- Put x = 0 into the rule and the constant is what is left.
- So y = 2x + 3 crosses at (0, 3).
- No constant means the line passes through the origin.

```
y = 2x + 3 crosses at (0, 3)
y = 2x − 1 crosses at (0, −1)
y = 2x crosses at (0, 0)
```

Plotting carefully

- Make a table of values first — never plot from memory.
- Two points are enough to fix a line.
- Always plot a third as a check.
- If the third point is off the line, one of the three is wrong.

```
y = 2x + 1
(0, 1) (2, 5) (4, 9)
all three in line ✓
```

Horizontal and vertical lines

- y = 4 means every point has y = 4, whatever x is.
- That is a horizontal line, four above the x-axis.
- x = −2 means every point has x = −2, whatever y is.
- That is a vertical line — and it has no gradient at all.

```
y = 4 horizontal
x = −2 vertical
y = 0 the x-axis itself
```

Parallel lines

- Two lines with the same gradient never meet.
- They differ only in where they cross the y-axis.
- The vertical gap between them is the difference of the constants.
- Spotting this saves drawing the graph at all.

```
y = 3x + 1
y = 3x + 7
same gradient → parallel, 6 apart
```

11.3 Reading real-life graphs

Read the axes first

- What quantity is on each axis, and in what units?
- How much is one square worth?
- Only then start reading values.
- More marks are lost to the scale than to the maths.

```
x-axis: time in hours, 1 square = 30 min
y-axis: distance in km, 1 square = 20 km
```

Conversion graphs

- They change one unit into another.
- They are straight lines through the **origin**.
- Because zero of one unit is zero of the other.
- Read across and up, or use the rate directly.

```
5 miles = 8 km
so 20 miles = 32 km
and 40 km = 25 miles
```

When a graph does not start at the origin

- A taxi charges a fixed amount before you move.
- So the line starts above zero.
- That starting value is the y-intercept.
- Ask yourself: is there a charge for doing nothing?

```
taxi: y = 2x + 5
0 km still costs 5
the graph starts at (0, 5)
```

Distance–time graphs

- Time along the bottom, distance up the side.
- The **gradient is the speed**.
- Steeper means faster.
- A flat section means stopped — time passes, distance does not.

```
150 km in 2 hours
gradient = 150 ÷ 2
speed = 75 km/h
```

Reading the story

- Every section of the graph describes part of a journey.
- Steep up: travelling away quickly.
- Flat: a stop.
- Downwards: coming back towards the start.

```
steep up → fast outward
flat → a rest
gentle down → slow return
```

Average speed

- Total distance divided by total time.
- It includes the stops — that is what makes it an average.
- So it is usually less than the fastest speed reached.
- Watch the units: minutes must become hours for km/h.

```
24 km in 90 minutes
90 min = 1.5 hours
24 ÷ 1.5 = 16 km/h
```