A LESSON ABOUT SPEED, UNITS AND PERCENTAGE CHANGE, FOR THE CLASSROOM OR A CLUB

Could you keep up with a world-record miler on a bike?

A 55-minute lesson for GCSE Foundation and Higher, and NCEA Level 1–2. It also works with curious students in Years 7–10, with an extension for those ready for more. It pairs with the short film *Maths in the News #4* and the student worksheet. The aim is a clear calculation of a world-record speed, careful unit conversion, and a feel for percentage change — not exam technique.

What you will need

- The student worksheet (pages 1–4; keep page 5, the answers, for yourself)
- The Short, if it is available — or the spoken hook below
- A calculator (the divisions are awkward by hand, and the point of the lesson is the method)
- Optional: the lesson page at ilovemaths.app/lessons/mile-world-record

Objectives

- Convert a race time in minutes and seconds into a single number of seconds.
- Calculate a speed as distance ÷ time, using the exact length of a mile, 1609.344 m.
- Convert between m/s and km/h by multiplying or dividing by 3.6, and explain why 3.6 works.
- Calculate a percentage change, and compare typical walking and cycling speeds with a race speed.

Curriculum

GCSE Foundation and Higher (compound measures: speed = distance ÷ time; converting compound units, including × 3.6 between m/s and km/h; percentage change). NCEA Level 1–2 (rates, metric unit conversion, percentage change, and interpreting figures in a news context). The extension, comparing Josh Kerr's record with Sam Ruthe's 3:58.35 and noticing that a percentage change in time is not the same as a percentage change in speed, is a natural step for Higher, NCEA Level 2, or a fast group.

The shape of the lesson

0–8 min — **Starter hook — play the Short if you can.** The film is 90 seconds long. If it is not yet on YouTube, use the spoken hook: "World Athletics has ratified a new mile record: 3:42.66, run by Josh Kerr, who was 28 and is from Edinburgh, Scotland. The old record had stood for 27 years, and he was only 0.47 seconds faster. Before we do any working: could you keep up with him on a bike?" Take two or three guesses. Do not correct yet. Ask what questions the film (or the hook) left them with.

8–22 min — **Main — times, a difference, and a percentage.** Page 1 of the worksheet. Convert 3:42.66 and 3:43.13 into seconds together if needed (Q1–Q3), then let students try the percentage in Q4. Linger on the idea that 0.21% looks tiny on paper and was still a world record. If someone writes 0.47 ÷ 3:42.66, ask them to put both quantities in the same unit first.

22–36 min — **Speed and unit conversion.** Page 2. Write "1 mile = 1609.344 m, exactly" on the board. Q5 and Q6 should feel familiar once the time is in seconds. Q7 is the one to talk through: 1000 m in a kilometre, 3600 s in an hour, so × 3.6. Q8 (using 1600 m by mistake) is a useful misconception; praise anyone who spots that the distance is too small before they reach the answer.

36–46 min — **The bike comparison and an average 400 m.** Page 3. Stress that the walking and cycling figures are typical values, not a cited study. Q9 and Q10 are "time = distance ÷ speed," with the mile written as 1.609344 km. Q11 uses the already-rounded 7.23 m/s. Q12 is there so that nobody pretends a mile is exactly 1600 m. If you have only 50 minutes, you can set Q12 or the whole extension as homework.

46–55 min — **Extension or plenary.** If the group is ready, page 4: Sam Ruthe, 15, 3:58.35 in Auckland in March 2025, the youngest ever sub-4-minute mile. E3 and E4 are the richest questions — a percentage change in time is not the same as a percentage change in speed. If you skip the extension, close with a one-sentence plenary: "Kerr's average speed was…" and "To keep up on a bike you'd need about…" Listen for 26.0 km/h, or 7.23 m/s, and for "a brisk ride." Thank effort and good questions by name, specifically.

Discussion questions you can drop in

- Why can 0.21% still be a world record if it looks so small?
- Could you keep up on a bike? What kind of ride is 26 km/h — a leisurely one, or a brisk one?
- Why does it matter that a mile is 1609.344 m, not "about 1600 m"?
- Josh Kerr was 28 and is from Edinburgh, Scotland. Sam Ruthe was 15 and is from New Zealand. Why might both performances be remarkable, in different ways?

Misconceptions to listen for

- **Leaving the time as 3:42.66, or treating it as 3.4266 minutes, or as 342.66 seconds.** The first step is always 3 × 60 + 42.66 = 222.66 s.
- **Using 1 mile = 1600 m, or 1.6 km.** The exact international mile is 1609.344 m. Q8 is there to show that 1600 m gives a speed that is a little too low (about 25.9 km/h instead of 26.0 km/h).
- **Dividing 222.66 by 4 and calling that an average 400 m.** That is the average time for a quarter of a mile, which is 402.336 m, not 400 m.
- **Forgetting why we multiply by 3.6, or multiplying by 60, or by 1000.** Keep 1000 m in a km and 3600 s in an hour on the board.
- **Treating the typical walking and cycling speeds as measured scientific averages, or as Kerr's speeds.** They are labelled typical values, for comparison only.
- **Confusing a percentage change in time with a percentage change in speed (E3 vs E4).** For a fixed distance they are related, but they are not equal, because speed and time are reciprocals.
- **Mixing up Kerr and Ruthe, or assuming the world-record holder is a New Zealander.** Kerr is Scottish, from Edinburgh; the world record is his. Ruthe's 3:58.35 is a remarkable junior mark, not the world record.

Differentiation

If students need more support

Do Q1 as a class, writing "× 60, then add the seconds" on the board, then let pairs try Q2 and Q3. For Q5, write the formula "speed = distance ÷ time" and let them only do the division. For Q7, start from "how many seconds in an hour?" and "how many metres in a kilometre?" rather than from 3.6 itself. You can skip Q8 and Q12, and leave the extension.

If students are ready for more

The extension on page 4 (E1–E5) is for Higher, NCEA Level 2, or a fast Foundation / Level 1 group. E1 and E2 practise the same method on a new time. E3 and E4 are the richest: 15.69 s is 6.58% of Ruthe's time, but Kerr's speed is about 7.0% greater — and both can be right. E5 is a "what if" about holding mile pace for 5 km; the caution is the point. A further challenge: show, algebraically, why a small percentage decrease in time is a slightly larger percentage increase in speed.

The facts — please keep these careful

Josh Kerr (Great Britain), born in Edinburgh, Scotland, on 8 October 1997, ran 3:42.66 for the mile in London on 18 July 2026, aged 28. World Athletics has ratified this as the men's mile world record, beating Hicham El Guerrouj's 3:43.13 from Rome, 7 July 1999. Kerr turned 29 on 8 October 2026; the film uses 28, his age at the record. Sam Ruthe (New Zealand), born 12 April 2009, ran 3:58.35 in Auckland on 19 March 2025, aged 15 years 341 days, and became the youngest athlete ever to run a sub-4-minute mile. Please do not say Kerr is a New Zealander, and please do not use athlete photographs — the film and the page use diagrams only. Walking about 5 km/h and cycling 15–20 km/h are typical teaching values, not a cited study. Update this if the official picture changes.

Links

- This lesson: **https://ilovemaths.app/lessons/mile-world-record** · the tutor app: https://ilovemaths.app · Jane's channel: youtube.com/@getsussed-y4h
- World Athletics press release (Kerr 3:42.66, ratified; El Guerrouj 3:43.13) and the records list (Kerr's date of birth): worldathletics.org — search "ratified world records Kerr" and the men's outdoor mile records list
- Athletics New Zealand, "Sam Ruthe Rewrites History", 20 March 2025: athletics.org.nz — 3:58.35, youngest ever sub-4-minute mile
- Guinness World Records, "Youngest athlete to run a four-minute mile": 15 years 341 days, born 12 April 2009. Also Reuters and BBC Sport, 19 March 2025.

For teachers: how students learn best with AI

The evidence is still early, and it is mixed. These points are here to be useful and honest — not to oversell I Love Maths, or AI in general. Links were checked in November 2026.

1. **AI is more likely to help when it supports understanding than when it does the work.** A November 2026 review by Stanford's SCALE Initiative (the AI Hub for Education) looked at 52 cause-and-effect studies. It found that using AI to understand new material is more promising than using it to produce the work — although neither use consistently improves learning. Using AI to offload the task can reduce what students later know.
2. **Treat sweeping "AI improves learning" claims with care.** An Education Week report (2 November 2026) covered an audit of 14 research reviews that all claimed positive effects. The audit found they failed basic research standards: they mixed very different studies, and often lumped together engagement, motivation or "how much students felt they had learned" with actual achievement.
3. **A few careful trials are encouraging, but they are still small.** In one randomised trial in Ghana, students who used Rising Academies' WhatsApp maths tutor Rori for two 30-minute sessions a week, over eight months, gained about 0.37 standard deviations in maths compared with a control group (around 1,000 students in grades 3–9, across 11 schools). That is a meaningful gain in education research, and the authors asked that these first-year results be interpreted carefully.
4. **Good design coaches step by step, rather than handing over the answer.** Google's Guided Learning mode in Gemini is built to ask questions and walk through the steps, rather than simply giving the answer. That is a design choice, in line with the idea above. It is not, by itself, independent proof that the tool improves results.
5. **When AI is used to mark work, human checks still matter.** NZQA uses automated text scoring for digitally submitted NCEA Literacy writing, and human markers check scripts around the Achieved / Not Achieved boundary (about 40% of assessments, in NZQA's published description). If the human mark differs, the human mark is used. This is about assessment marking, not tutoring — it is a reminder that AI works best as a support, with people still in the loop.
6. **The older findings about how people learn still apply, with or without AI.** Students generally learn more when they have to pull ideas out of memory (retrieval practice), explain their thinking (self-explanation), work through a genuine challenge rather than being rescued too quickly (productive struggle), and get feedback on their method, not only on the final answer.

How I Love Maths uses this

I Love Maths is built to support understanding, not to do the work for the student. The tutor asks questions before it gives answers. To reach "Mastered" on a topic, a student needs to type an explanation in their own words. If they send a photo of their working, it is marked for method — and the photo is not stored.

Sources (checked November 2026):

1. Stanford SCALE, "The Evidence Base on AI in K-12: A November 2026 Review" — https://scale.stanford.edu/ai/evidence-base-review/evidence-base-ai-k12-november-review
2. Stephen Sawchuk, "The Research on AI in Education Is a Mess", *Education Week*, 2 November 2026 — https://www.edweek.org/technology/the-research-on-ai-in-education-is-a-mess/2026/11
3. Owen Henkel, Hannah Horne-Robinson, Nessie Kozhakhmetova and Amanda Lee, "Effective and Scalable Math Support: Evidence on the Impact of an AI-Tutor on Math Achievement in Ghana" (arXiv, May 2024 version) — https://arxiv.org/abs/2402.09809
4. Google, "How Gemini's Guided Learning can help you study more effectively", 23 September 2025 — https://blog.google/products-and-platforms/products/gemini/guided-learning-google-gemini/
5. NZQA, "How we mark co-requisite assessments" — https://www2.nzqa.govt.nz/ncea/subjects/litnum/marking/
6. Retrieval practice: https://www.retrievalpractice.org/ · Michelene Chi and colleagues, "Eliciting Self-Explanations Improves Understanding", *Cognitive Science*, 1994 — https://onlinelibrary.wiley.com/doi/10.1207/s15516709cog1803_3 · Manu Kapur, "Productive Failure in Learning Math", *Cognitive Science*, 2014 — https://onlinelibrary.wiley.com/doi/full/10.1111/cogs.12107 · John Hattie and Helen Timperley, "The Power of Feedback", *Review of Educational Research*, 2007 — https://journals.sagepub.com/doi/10.3102/003465430298487

Jane, an experienced maths teacher
I Love Maths — a friendly maths tutor for GCSE and NCEA students who want maths to make sense again.
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