Could a marathon ever be run in under two hours? Teachers'Notes

This resource is based on an article by the BBC in April 2011. This article asks the above question.

This activity is designed to help learners:

- think analytically about a statistical problem using the Problem Solving Cycle;
- plot and interpret time series graphs;
- make predictions;
- report and discuss results;
- draw conclusions;
- convert units of measure and time;
- calculate speeds.

Task A possible answers

1. A time series graph.
2. The world record times for the men's marathon over successive times spaced at uniform time intervals.
3. The graph falls sharply between 1908 and 1909, the slope is less steep and falls steadily between 1909 and 1970, from then on the slope is almost flat. Compare the gradients between 1925– 1947 and between 1968 – 2008.
4. No as the interval is quite small and there are times written on the line at particular points.
5. The graph is not very clear. It should have been plotted as a horizontal graph. Also some comment that zero is not included on the time scale.
6. For 12 years. This happened twice between 1935 and 1947 and again between 1969 and 1981.
7. Wind speed, altitude, weather, temperature, the marathon route, number of hills, shoe technology.
8. Looking for a sensible comment here. The BBC article suggests yes but it will take about another 25 years. Not a good idea to extrapolate beyond the data.

Task B answers

Using 1760 yards = one mile. One metre = 1.0936 yards.

	Distance	Time
Haile Gebrselassie	26 miles 385 yds	2hours, 3 minutes, 59 seconds
A 2 hour Marathon	26 miles 385 yds	2 hours
Michael Johnson	400 metres	43.18 seconds

Speed for Haile Gebrselassie - convert to miles and hours.

26 miles 385 yds $= 26\frac{385}{1760} = 26.2187$ miles

2 hours 3 minutes and 59 seconds $= 2 \text{ hours } 3\frac{59}{60} = 2 \text{ hours } 3.9833 \text{ minutes}$

$= 2\frac{3.983333}{60}$ hours $= 2.0664$ hours

Therefore speed for Haile Gebrselassie $= \frac{26.2187}{2.066389} = 12.6882 =$ **12.7 mph**

Speed for 2 hour marathon $= \frac{26.2187}{2} = 13.1094 =$ **13.1 mph**

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Speed for Michael Johnson – convert to miles and hours

400 metres = 400 × 1.0936 = 437.44 yds = $\frac{437.44}{1760}$ = 0.2485 miles

43.18 seconds = $\frac{43.18}{60}$ = 0.7197 minutes

0.719667 minutes = $\frac{0.719667}{60}$ = 0.0120 hours

Therefore Speed for Michael Johnson = $\frac{.248545}{0.011994}$ = **20.7224** =**20.7 mph**

The BBC are not correct with 20.71 miles per hour.

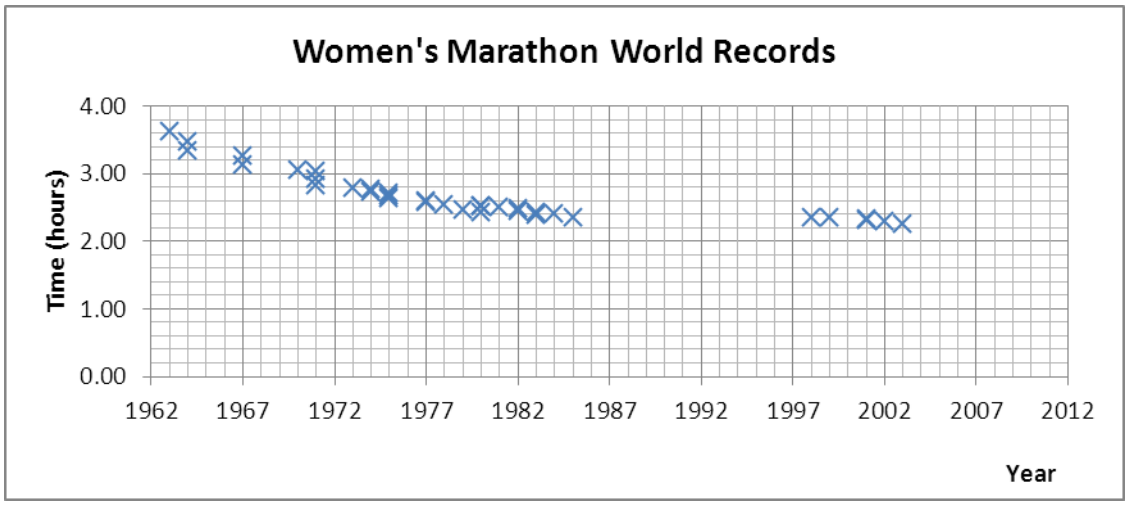
Task C

Investigate if women will ever run the marathon in less than 2 hours?

1. A time series.
2. Horizontal is easier to interpret.
3. It is good practice to include zero where possible.
4. Include all the data.
5. See Figure 1
6. See Figure 1
7. To two decimal places for the time.

Comment on your graph.

1. There is a large period between 1985 and 1998 when the world record was held.
2. A curve…definitely not a straight line.
3. A sensible remark here. To do this women have to run each mile a minute faster (on average).
4. Possibly as the curve is flattening.



Task D

Speed for Paula Radcliffe in 2003 = $\frac{26.2187}{2.26}$ = 13.1094 =**11 .60 mph**

Task E

- Look at the men's and women's 100m. See resource How far? How fast? How high? www.sportatschool.org.uk Get Started/Follow-up Lessons.
- Are men faster than women? Will women run the 100 m under 10 seconds?
- Look at your school's sport records and plot the times on the same graph as the world records.