

# Marathon Glory!

Student Name:

Answers

## Background

Marathon athletes have never before been equipped with such impressive works of engineering and technology on their feet. The major shoe companies are constantly striving to seek the edge for their athletes, to help compliment their training and nutrition.

## Task

Use the information provided below to calculate the athletes percentage difference or 'improvement' in the marathon over the last few years.

## Data

|   |         |  |         |  |           |
|---|---------|--|---------|--|-----------|
|   |         |  |         |  |           |
| <b>Jared Ward<br/>USA</b>   |         | <b>Mosinet Geremew<br/>ETHIOPIA</b>  |         | <b>Eliud Kipchoge<br/>KENYA</b>  |           |
| Wears Saucony Type A  |         | Wears Nike ZoomX Vaporfly<br>Next %  |         | Wears Nike ZoomX Alphafly<br>Next %  |           |
| <b>Personal Best Times</b>  |         | <b>Personal Best Times</b>   |         | <b>Personal Best Times</b>   |           |
| 2015  | 2:12:55 | 2016   | 2:04:00 | 2013   | 2:05:30   |
| 2016  | 2:13:00 | 2017   | 2:06:12 | 2016   | 2:08:44   |
| 2016  | 2:11:30 | 2018   | 2:05:24 | 2018   | 2:01:39*  |
| 2019  | 2:10:45 | 2019   | 2:02:55 | 2019   | 1:59:40** |
| <p>* Fastest marathon time ever recorded in a sanctioned event. Current worlds best time.</p> <p>** Fastest marathon time ever, however it was an organised event to try and break the 2-hour mark so Kipchoge was allowed pacers, wind breaks and ran laps on a fat formula one circuit. It therefore does not stand as the world's best time, however proves it is humanly possible to run a marathon in under 2-hours.</p> |         |  |         |  |           |

## Example Calculations

To calculate the percentage difference or 'improvement' of an athlete's marathon times you need to use the following formula where **A** is the athlete's slowest marathon time (min) and **B** is the athlete's fastest marathon time (min).

$$\text{Percentage difference} = \frac{A - B}{\left(\frac{A + B}{2}\right)} \times 100$$

A is the athlete's slowest marathon time (min)

B is the athlete's fastest marathon time (min)

### Example Marathon Times

Slowest marathon time = 2:23:10

Fastest marathon time = 2:16:56

**Step 1.** Convert the marathon time from hours:minutes:seconds format (as shown above) to only minutes (rounding to the nearest minute).

A. Slowest marathon time - 2:23:10 = 143 minutes

B. Fastest marathon time - 2:16:56 = 137 minutes

**Step 2.** Substitute marathon times (minutes) into the formula.

$$\text{Percentage difference} = \frac{143 - 137}{\left(\frac{143 + 137}{2}\right)} \times 100$$

**Step 3.** Complete calculations within the bracket; addition first then division.

1.  $143 + 137 = 280$

2.  $280 \div 2 = 140$

$$\text{Percentage difference} = \frac{143 - 137}{\left(\frac{280}{2}\right)} \times 100$$

$$\text{Percentage difference} = \frac{143 - 137}{140} \times 100$$

**Step 4.** Complete subtraction.

1.  $143 - 137 = 6$

$$\text{Percentage difference} = \frac{6}{140} \times 100$$

**Step 5.** Complete division (round to 4<sup>th</sup> decimal place).

1.  $6 \div 140 = 0.0429$

$$\text{Percentage difference} = 0.0429 \times 100$$

**Step 6.** Complete multiplication (round to 2<sup>nd</sup> decimal place).

1.  $0.0429 \times 100 = 4.29$

$$\text{Percentage difference} = 4.29$$

**Solution.** This athlete's marathon time improved by 4.29%.

# Calculating Improvement

1. Calculate Jared Ward's improvement between his slowest and fastest marathon times using the percentage difference formula. Take a photo of your calculations (ensure you are writing out each step) and insert the image below.

**NOTE: Your working out should look similar to this.**

Slowest time - 2:23:10  
Fastest time - 2:16:56

STEP 1  
Slowest time - 143 mins  
Fastest time - 137 mins

STEP 2 =  $\frac{143 - 137}{\left(\frac{143 + 137}{2}\right)} \times 100$

STEP 3 =  $\frac{143 - 137}{\left(\frac{280}{2}\right)} \times 100$   
=  $\frac{143 - 137}{140} \times 100$

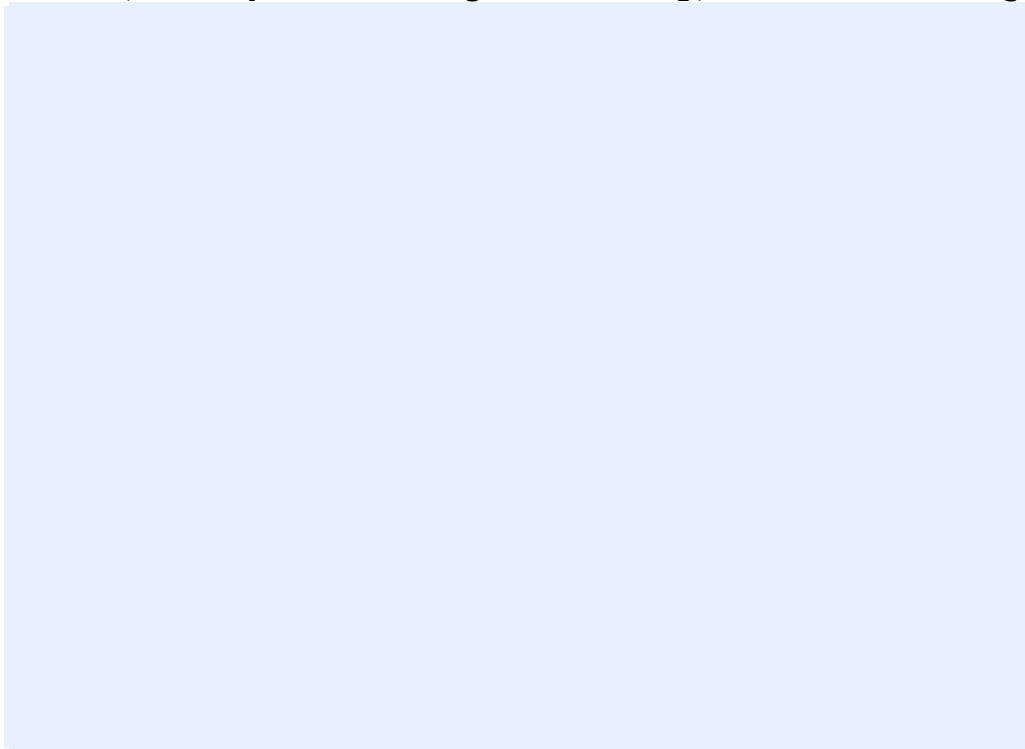
STEP 4 =  $\frac{6}{140} \times 100$

STEP 5 =  $0.0429 \times 100$

STEP 6 =  $4.29\%$

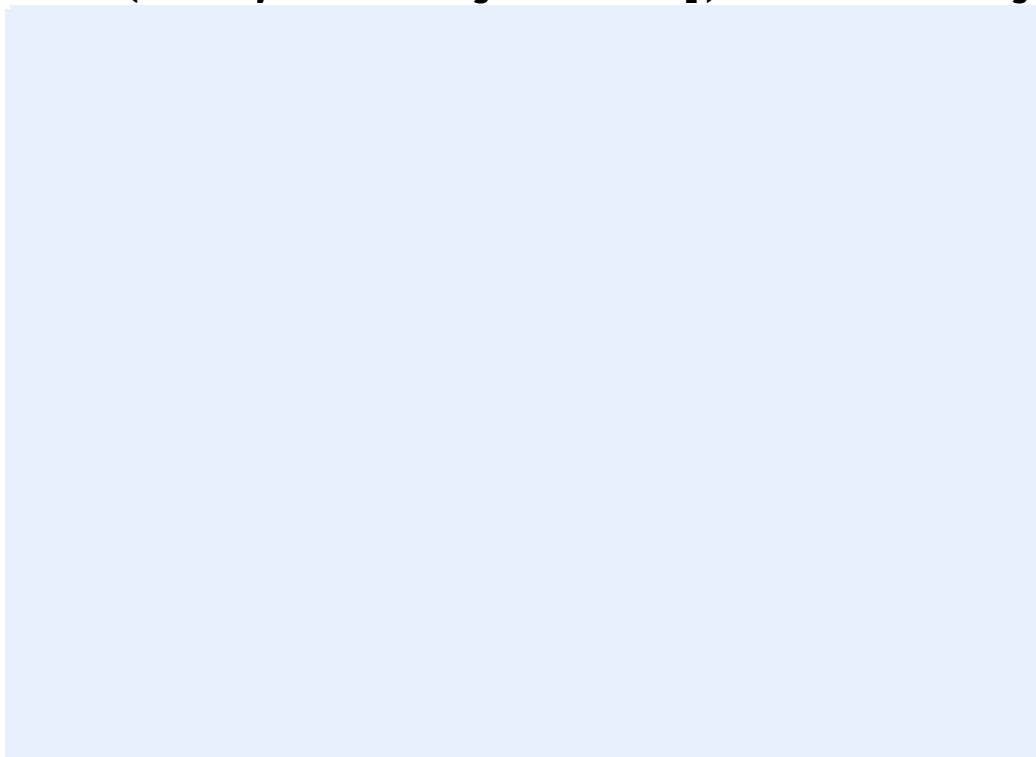
**Solution.** Jared Ward's marathon time improved by 1.52%.

2. Calculate Mosinet Geremew's improvement between his slowest and fastest marathon times using the percentage difference formula. Take a photo of your calculations (ensure you are writing out each step) and insert the image below.



**Solution.** Mosinet Geremew's marathon time improved by 2.41%.

3. Calculate Eliud Kipchoge's improvement between his slowest and fastest marathon times using the percentage difference formula. Take a photo of your calculations (ensure you are writing out each step) and insert the image below.



**Solution.** Eliud Kipchoge's marathon time improved by 7.23%.

# Conclusion

There are many factors that impact an athlete's performance and improvement, especially in marathon running. Look back at the athlete profiles on page one and the calculations you completed to help you answer the following questions.

**1. Which shoe was associated with the largest percentage change?**

Nike ZoomX Alphafly Next%

**2. Research the Nike ZoomX Alphafly Next% by clicking on the link below and identify 4 factors that make it such a unique running shoe.**

<https://www.wired.co.uk/article/nike-alphafly-eliud-kipchoge>

<https://www.wired.co.uk/article/nike-vaporfly-next-percent-london-marathon>

- Carbon fibre plate: acts like a spring, propelling the athlete forward.
- ZoomX foam: soft and cushioned but also returns 80% of energy exerted to the athlete
- Atomknit upper: lightweight upper that doesn't absorb water
- 2 x Air Pods: extra cushioning/suspension

**3. Why has the World Athletics made new specification limits on shoes based upon the Nike ZoomX Alphafly Next%?**

World Athletics believes the Nike shoes are damaging the integrity of running.

**4. List some factors other than the shoe that could have contributed to the athletes' improvement?**

- Training
- No set backs or injuries
- Where you are born – African runners have a genetic make-up that predisposes them to endurance running
- High altitude training – increase red blood cells

# Extension

The Nike ZoomX Alphafly Next% has had a major impact on World Athletics, with the governing body changing rules to essentially ban the shoe.

Research another example where the engineering of shoe wear, clothing or equipment has had a detrimental impact on the sport.

