**Pre-Release Data Booklet 2023**

**Sample Questions**

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**Use the pre-release data booklet to answer the following questions.**

**https://www.sqa.org.uk/sqa/files\_ccc/X844-76-11\_NH\_Applications-of-Mathematics\_Data-booklet\_2023.pdf**

1. Alexandra earns £2400 per month, plus a commission of 4% on all the sales she makes over £200. In September 2022, Alexandra makes £500 worth of sales. Each month, Alexandra contributes 8% of her pay into her pension pot.
   1. Alexandra says “This September I will pay £155.16 in National Insurance.” Explain the mistake Alexandra has made.
   2. Calculate the actual amount of National Insurance that would be due for September.
   3. In October Alexandra decides to increase her pension contributions from 8% to 11%. Explain what effect, if any, this will have on her:
      1. Income tax payment for October.
      2. National Insurance contribution for October.
2. Lucy started her first job on 6th June 2022. Her salary was £21 000, and she was paid monthly on the 5th of each month.

Lucy contributes towards her pension, paying in 8% of her monthly pay each month.

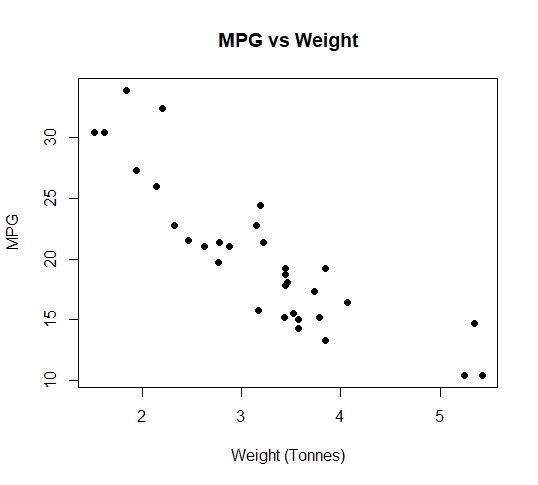
1. Calculate Lucy’s total income tax for the period 6 April 2022 to 5 April 2023.
2. Calculate Lucy’s total National Insurance contributions for the period 6 April 2022 to 5 April 2023.
3. Calculate Lucy’s total net pay for the period 6 April 2022 to 5 April 2023.
4. Estimate the number of tonnes of CO2 one car produces in its lifetime. Write down any assumptions you make.
5. **In this question, use 1 litre = 0.22 gallons.**

Kerys drives to work. Her only use of her car is commuting to and from work. Her home is 11 miles away from her place of work. Her car gets 35 miles to the gallon (mpg).

In August 2021 the average price of petrol was 135.16 pence per litre. In September 2021 the average price was 135.9 pence per litre.

E10 petrol was introduced in Scotland in September 2021. Kerys switched to E10 at the beginning of September. By considering the change to her fuel economy, and the change in price of petrol, estimate how much more Kerys spent on petrol in September compared with August.

1. Megan collects some data about vehicle weights, and the numbers of miles per gallon that vehicle gets. She makes the following plot:



Which of the following would be the best model for this data:

Linear

Exponential growth

Exponential decay

Quadratic

Give a reason for your answer.

1. One month, E10 was 163.5p a litre on average, and E5 was 166.4p. Vakaris’ car carries 55 litres of fuel.
   1. Find the difference in price of filling his car with E10 compared with E5 fuel.

Vakaris’ car gets 19 kilometres per litre using E5 fuel.

* 1. Calculate the number of kilometres per litre he would get with E10 fuel.
  2. For which fuel would £20 be the better value for Vakaris?

1. A popular AI ‘chat-bot’ was given the pre-release datasheet and asked to write a maths question. Below is its output:

The UK government plans to reduce transport CO2 emissions by 750 000 tonnes a year by introducing E10 petrol. This is equivalent to taking 350 000 cars off the road. If each car emits 2.5 tonnes of CO2 per year, how many cars are currently on the road in the UK?

Solution:

Let x be the number of cars currently on the road in the UK.

2.5x = 750 000 + 350 000

2.5x = 1 100 000

x = 440 000

Therefore, there are currently 440 000 cars on the road in the UK.

Critique this question.

1. Not all vehicles on roads in the UK are compatible with E10 fuel. The RAC Foundation has shared the following information:

In 2017, the manufacturers with the highest number of E10 incompatible cars on the road were:

Rover – 91,624 vehicles

MG – 75,827

VW – 61,398

Nissan – 55,139

Mazda – 46,040

Ford – 37,578

Toyota – 36,646

Peugeot – 27,217

Austin – 26,368

Triumph – 24,943

Represent this information on a suitable diagram.

1. The spreadsheet file “oil-use.csv” contains data about the amount oil used by different countries between 2008 and 2016. Liyana is interested in how oil use has changed over time.
   1. Generate a suitable measure of central tendency for each year.
   2. Represent this data in a suitable diagram for Liyana.

Liyana decides to complete an unpaired t-test, comparing data from 2008 with 2016.

* 1. Give three reasons why this is not appropriate.