

MATHEMATICS 3 PERIODS

PART A

DATE: 30th January 2023, 13:30

Duration of the examination: 2 hours (120 minutes)

Teacher: Mr **ASHBOURNE**

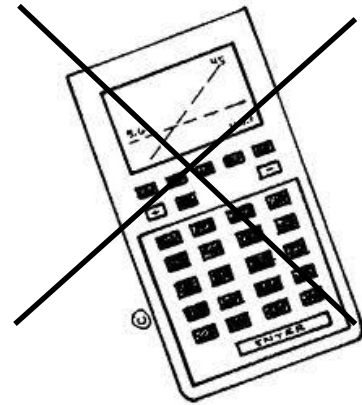
Total mark out of 50

AUTHORIZED MATERIAL:

No technological tool permitted

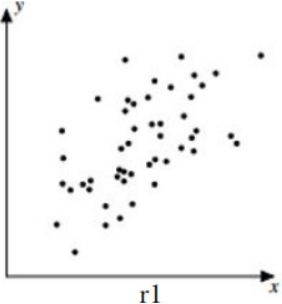
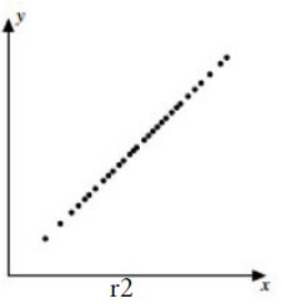
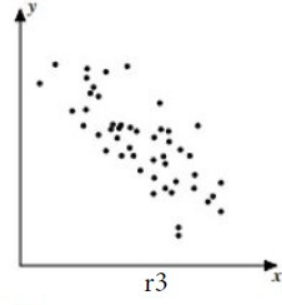

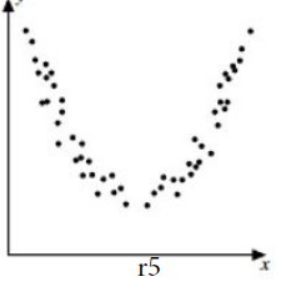
Pencil for graphs and diagrams

There are 10 questions



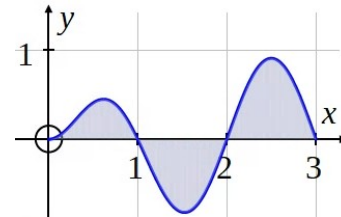
SPECIFIC INSTRUCTIONS:

- Unless indicated otherwise, full marks will not be awarded if a correct answer is not accompanied by supporting evidence or explanations of how the results or the solutions have been achieved.
- When the answer provided is not the correct one, some marks can be awarded if it is shown that an appropriate method and/or a correct approach has been used.

Question 1	Mark
<p>Arrange, by increasing order of size, the linear correlation coefficients, r_1, r_2, r_3, r_4, and r_5, seen in these scatter diagrams.</p> <p>Give reasons for the order you have identified.</p> <p><i>Note that the axes of all the diagrams are to the same scale.</i></p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="text-align: center; margin: 10px;">  <p>r_1</p> </div> <div style="text-align: center; margin: 10px;">  <p>r_2</p> </div> <div style="text-align: center; margin: 10px;">  <p>r_3</p> </div> <div style="text-align: center; margin: 10px;">  <p>r_4</p> </div> <div style="text-align: center; margin: 10px;">  <p>r_5</p> </div> </div>	5
Question 2	
<p>In a group of 500 pupils, 200 belong to the chess club, 240 to the reading club and 80 to both clubs.</p> <p>Calculate the probability that a pupil chosen at random does not belong to the chess club, given that they do not belong to the reading club.</p>	5

Question 3

A new company logo is shown on the right and will be made out of steel to be displayed outside the headquarters.
The curve is defined by the function $y=f(x)$



a) **Identify** which two of the following integrals would correctly calculate the area of steel required.

2.5

- ① $\int_0^1 f(x)dx + \int_1^2 f(x)dx + \int_2^3 f(x)dx$
- ② $\int_0^3 f(x)dx$
- ③ $\int_0^3 |f(x)|dx$
- ④ $\int_0^1 f(x)dx - \int_1^2 f(x)dx + \int_2^3 f(x)dx$

b) **Explain** why the other integrals would give an incorrect answer.

2.5

Question 4

At the start of 2022 a company bought a machine for 100 000 € to make plastic items.

Each year the machine loses 20% of its value.

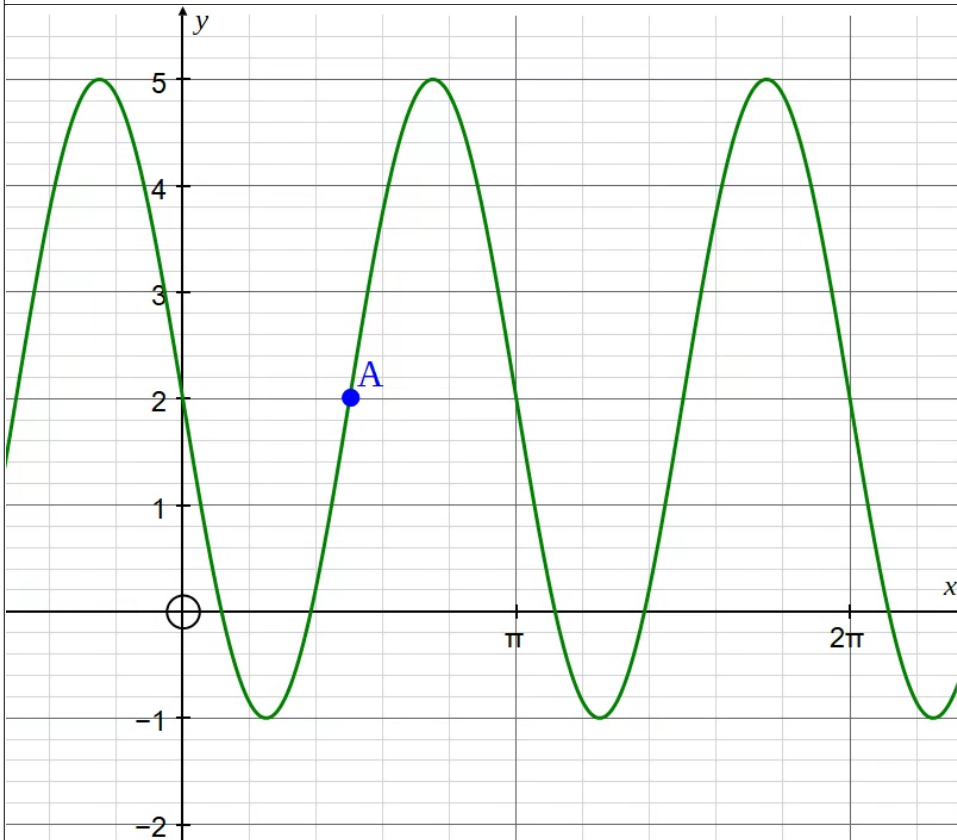
a) **Show** that a possible formula to model the value after x years is
 $P(x) = 100000 e^{\ln(0.8)x}$

3

b) **Calculate** the value of the machine at the start of 2024.

2

Question 5



The graph shown above is of a sine function, $f(x)$, defined by:
 $f(x) = a \sin(b(x-c)) + d$

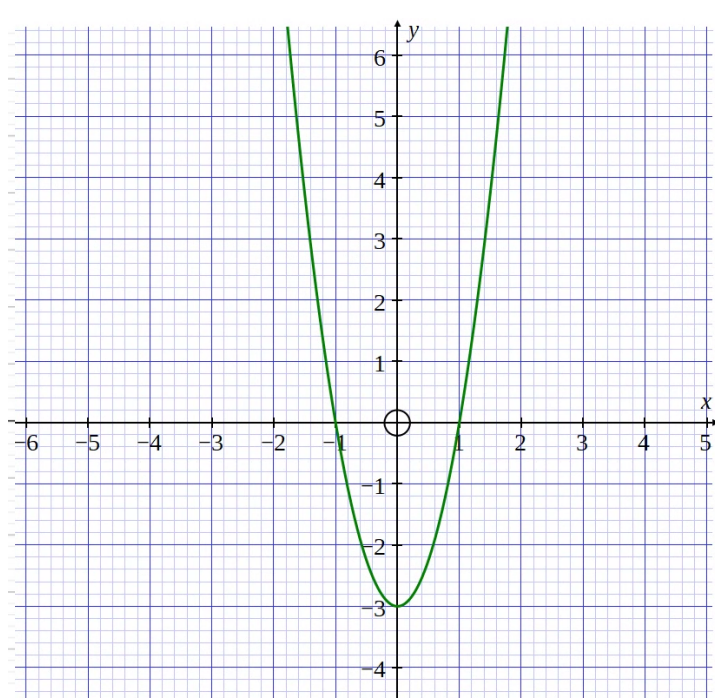
Based on the information in the graph:

- a) Find the period P and hence the value of b 1.5
- b) Find the amplitude of the function and hence the value of a 1.5
- c) State the coordinates of the point A and hence find the values of c and d . 2

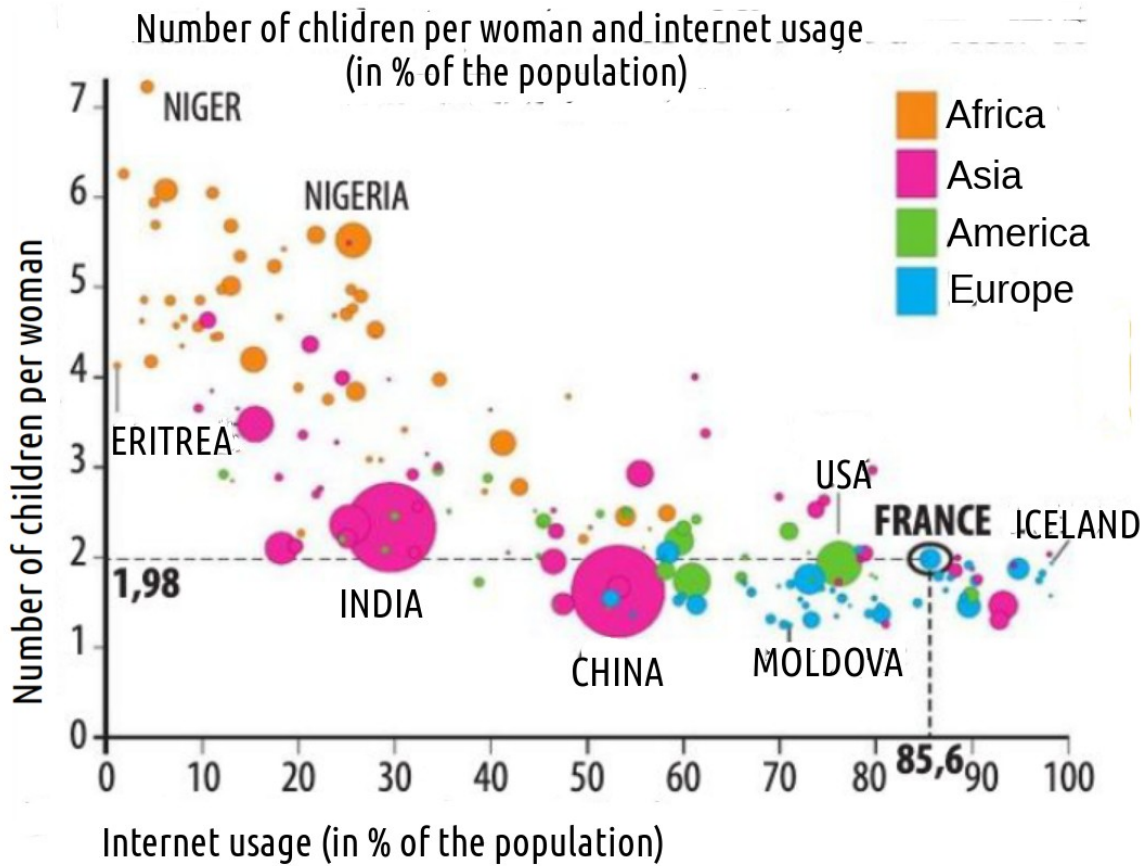
Question 6

Given $f(x) = -x^2 + 2x + 3$

- a) Find an expression for the derivative $f'(x)$ 2.5
- b) Find an equation for the tangent to the graph of $y = f(x)$ at the point where $x = 2$ 2.5

Question 7	
<p>The height of a tree in cm is given by the function $h(t)$, where t is the number of weeks since it was planted.</p> <p>Give an interpretation concerning the growth of the tree for each of the following:</p> <p>a) $h(3)=80$</p> <p>b) $h'(2)=4$</p> <p>c) The value of t when $h'(t)=0$</p>	<p>2</p> <p>1.5</p> <p>1.5</p>
Question 8	
<p>The graph represents the derivative of a function f</p>  <p>a) Determine how the sign of the derivative depends on the value of x</p> <p>b) Hence describe how the graph of function f varies in gradient.</p>	<p>2.5</p> <p>2.5</p>

Question 9



1

- State the variables of this graph 1
- Identify the way in which the variables are correlated in the graph 2
- Explain any causality that there might be between the variables 2

1 Graph from <https://www.gapminder.org/tools/>

Question 10

A statistical study of two numerical variables produces the scatter diagram on the right

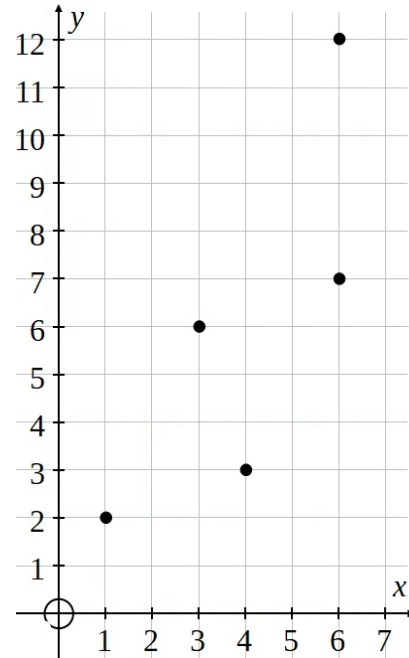
- a) **Show by calculation** that the coordinates of the mean point are (4, 6)

$y = \frac{5}{4}x + 1$ is chosen as a regression line for the data

- b) **Show by calculation** that the mean point lies on this line

- c) **Calculate** the value of y corresponding to $x = 2$

- d) We can establish from the line that a value of $y = 38.5$ corresponds to a value of $x = 30$
Comment on the whether such an extrapolation is reasonable.



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1.5

1.5

