Mathematics: Applications and Interpretations SL

Paper 1.

Version 2

MOST ANSWERS ARE HERE.

PLEASE TELL ME WHICH YOU GOT WRONG DURING OUR NEXT LESSON,
SO WE KNOW WHAT TO FOCUS ON :)

1. A cuboid has the following dimensions:

$$l = 5\,m$$

$$w = 3\,m$$

$$h = 6\,m$$

a) Work out the volume of the cuboid. (2)

b) Assuming each figure has been rounded to the nearest metre, work out the maximum possible volume. (2)

c) By displacement, the volume is confirmed to be the value calculated in b. Work out the percentage error when compared to the answer in a). (2)

a) V= 90 m3

b) Max bound : V= 5.5 x 3.5 x 6.5
              V= 125 m3 (3 s f)

c) 28.1 %

2. The scores attained in an English test and French test are recorded for 10 students:

English	12	15	18	10	17	19	7	4	18	17
French	10	13	19	8	15	17	10	7	16	12

a) Find the value of Pearson's r (1)

b) Comment on r, stating a limitation of the value. (2)

c) It is known that another classmate scored 14 in French. This student was absent for the English exam. By generating the proper equation of regression, predict the grade this student might have scored in English. Comment on the reliability of the predicted grade. (4)
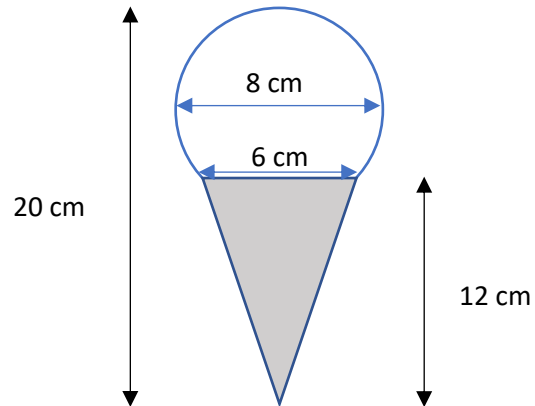
a) r= 0.880

b) Strong positive.
   Correlation does not equal causation.
   Outliers can impact Pearson's r

c) x = my + c
   x=1.14573.. (14) -.0850798..
   x=16.0 marks

   interpolation for strong correlation, reliability ok.

3. The cross section of a toy has this shape:

8 cm

6 cm

20 cm

12 cm

a) Determine the area of the shaded component. (2)

b) Determine the area of the circular component (5)

a) A = 36 cm2

b) A = 39.69 + 15.87cm2
   A = 55.6 cm2

4. The prizes for winning a game are distributed as follows:

Prize ($)	0	2	4	5
Probability	0.15	0.25	p	0.10

a) Solve for p, the probability of winning $4.

b) Find the expected mean of prize awarded.

c) Hence, conclude how much the owner should charge so the game is fair.

a) p = 0.5

b) E(x) = $ 3.00

c) $3.00 so mean is 0.

5. The number of white, black, red and "other" coloured cars in a lot are recorded:

Colour	White	Black	Red	Other
Probability	75	43	17	15

John read a statement indicating that 40% of cars are white, 35% are black, 10% are red and the rest are other colours.

He decides to carry out a chi goodness of fit test to determine if the statement can be supported at the 5% significance level.

a) State the null and alternative hypotheses (2)

b) Calculate the p-value. (2)

c) Conclude on the statement John had read. (2)

a) Ho: distribution is followed (p white = .4, p black = 0.35, etc...)

Ha= distribution is not followed

b) L2: 60, 52.5, 15, 22.5
p = 0.0414

c) Reject Ho, b/c 4.14% is less that 5%

6. The time taken to commute to work is recorded for 100 individuals:

Time to commute, t, in minutes	Frequency
$0 \leq t < 10$	65
$10 \leq t < 20$	x
$20 \leq t < 30$	10
$30 \leq t < 40$	8

a) Work out the value of x, stating an assumption you are making. (2)

b) State the modal class. (1)

c) Using your graphical display calculator, work out an estimate for the

      i) mean

      ii) variance (3)

a) x = 17 if no one took longer than 40 minutes

b) 0 </= to < 10

c) mean = 11.1
   Var= 91.8

7. Evelyne is starting a company. She will offer a service that costs 76 USD per hour (h), after an initial membership charge of 20 USD. Her competitor, Lea, is starting the same but charges a flat rate of 92 USD per hour.

    a) Express the cost function for Evelyne's company, C_E , in terms of h (2)

    b) Express the cost function for Lea's company, C_L , in terms of h (1)

    c) Calculate how many hours need be booked for Evelyne's offer is less expensive than Lea's. (3)

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a) Ce= 76h + 20

b) CL= 92 h

c) more than 1.25

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8. A function, $f(x)$ has been graphed:
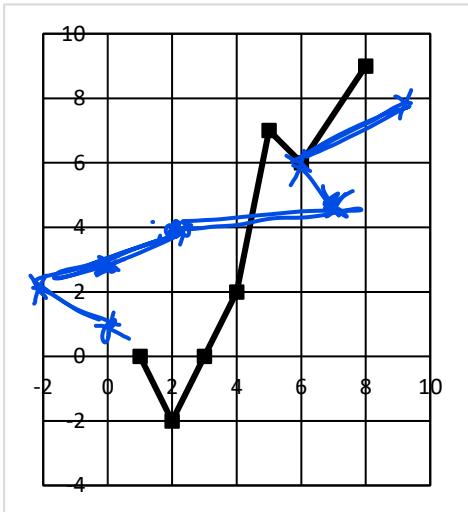
a) State the range of the function, $f(x)$. (2)

b) Explain why $f(x)$ is a function. (1)

c) Sketch the inverse of $f(x)$ on the same axes. (2)

d) Explain why the inverse is not a function. (1)

e) State the value of $f^{-1}(-2)$. (1)

f) Suggest a domain for the inverse so that it would

be a proper function. (2)

a) -2 =< y =< 9

b) passes vertical line test. One x value = one y value

c)

d) does not pass vertical line test. Ex. when x= 0, y= 1 and 3.

e) when y = -2, x = 2

f) Different answers possible.

9. The position of a rocket, in kilometers, before takeoff is $(15, 20, 1)$ in relation to a mission headquarters, H, defined as $(0, 0, 0)$. A quarter of an hour after lift-off, it is in the position with coordinates $(20, 40, 120)$.

   a) Determine the distance the rocket travelled in that time frame. (2)
   b) Hence, work out the speed of the rocket in kmh^{-1}. (2)
   c) The rocket launched a payload half-way through this journey. Determine the coordinates of the rocket when it released the payload, given that the rocket was initially 1 km above sea level. (3)

10. The swinging of a pendulum is modelled over a 6 second interval and the data is plotted. The experimenter models the motion with the following equation: $y = a\sin(bx) + c$

Given the maximum height above the ground reached by the pendulum is 33.5 m after 1.5 seconds, and the minimum height is 6.5m after 4.5 seconds:

a)   Write down the value of c (1).

b)   Work out the value of the amplitude (2)

c)   Hence, state the value of a. (1)

d)   Show that $b = 60$ (2)

e)   Work out the length of time the pendulum is more than 25m above the ground.
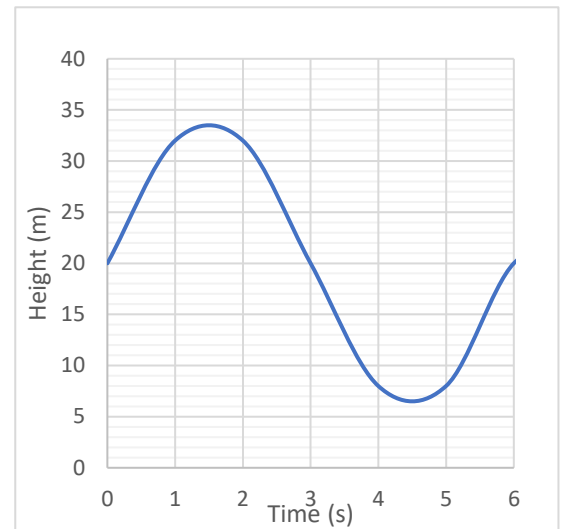
a) c= 20

b) 13.5

c) a = 13.5

d) b = 360/period
    b = 360/6