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Time: 3 hours

Examiner: Ms C Sam

Marks: 150

Moderator: Mr CVD Venter

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

- This question paper consists of 20 pages and 5 questions. There is a formula sheet included on the last page. Please ensure that no pages are missing.
- Write your name on this question paper.
- Answer all questions in the spaces provided on the question paper.
- You may use a non-programmable calculator.
- Round off to 2 decimal places unless otherwise stated or where the context requires rounding up or rounding down.**
- It is in your interest to show all working, to write legibly, and to present your work neatly.
- All diagrams are not drawn to scale.
- Use 3.14 wherever you must substitute for π .

Question One

Its Aliana's 21st birthday in November. She receives quotes from 4 different birthday party venues as shown below:

Venue 1 charges R450 per head

Venue 2 charges R300 per head but also charges a set fee of R10 000 for the use of the venue

Venue 3 has a price breakdown as follows:

Number of Guests	Total Cost
0 – 50	R20 000
51 – 100	R40 000
101 – 150	R60 000
150 or more	R60 000 + R200 per guest over 150 guests

- Venue 4 charges R250 per head, a venue hire of R13 750 and an additional non-refundable deposit of R6 250. If the event is not cancelled, the R6 250 will be used to pay for the first 25 guests, which is the minimum number of guests that are charged for.

- Write down an equation that represents the costs involved with Venue 2. (2)

$$C = 10\,000 + 300n$$

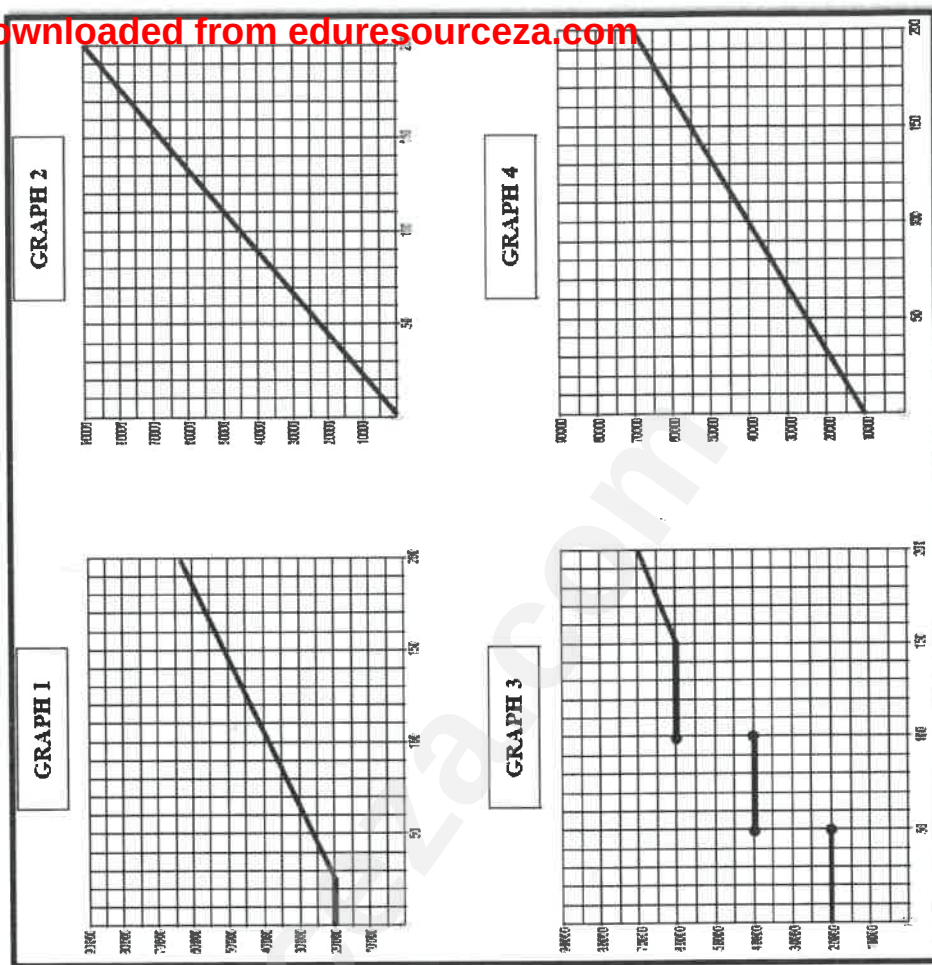
- Refer to the graphs below. Each of the 4 quotes has been graphically illustrated. Match each graph to the correct venue.

Graph 1 = Venue 4

Graph 2 = Venue 1

Graph 3 = Venue 3

Graph 4 = Venue 2



3. Determine by means an equation the number of guests that must be invited for the cost of Venue 1 to equal the cost of Venue 2.

$$450n = 10000 + 300n$$

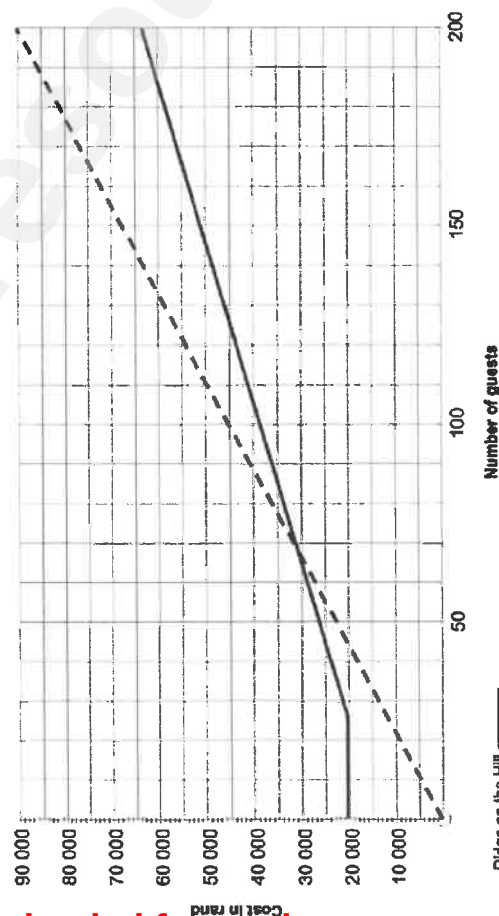
$$150n = 10000$$

$$n = 66,66 \dots$$

$$\approx 67$$

equation, equating mfa rounded off

4. Aliana has narrowed her choices down to two venues, namely "Ridge on the Hill" and "Views". The quotes for these two venues are plotted on the same set of axes below, which must be referred to when completing the following paragraph.



- Aliana would like a small birthday party therefore she is happy to invite only 50 guests. The cheapest venue for the 50 guests is i) Views
- Her mother wants a bigger party and she was planning to invite about 200 people, and as such, the cheapest venue to use would be ii) Ridge on the Hill
- Aliana's father is only prepared to spend R50 000 on the venue, thus, she can only have a maximum of iii) ±145
- people at her party. However, Aliana really wants her party at 'Views', however, she may only have a maximum of iv) ±110 people at her party.

- b. Aliana's father, Mr Samad, invested a lump sum of money many years ago. A portion of that investment is shown below.

Opening Balance	Interest per month	Closing balance
R 30 000.00	R 210.00	R 30 210.00
R 30 210.00	R 211.47	R 30 421.47
R 30 421.47	R 212.95	R 30 634.42
R 30 634.42	R 214.44	R 30 848.86
R 30 848.86	R 215.94	R 31 064.80
R 31 064.80	R 217.45	(a)
R 31 282.25	R 218.98	R 31 501.23
R 31 501.23	R 220.51	R 31 721.74
R 31 721.74	R 222.05	R 31 943.79
R 31 943.79	R 223.61	R 32 167.40
R 32 167.40	R 225.17	R 32 392.57
R 32 392.57	R 226.75	R 32 619.32
(b)	R 228.34	R 32 847.66
R 32 847.66	R 229.93	R 33 077.59
R 33 077.59	R 231.54	R 33 309.13
R 33 309.13	R 233.16	R 33 542.30
R 33 542.30	R 234.80	R 33 777.09
R 33 777.09	R 236.44	R 34 013.53
R 34 013.53	R 238.09	R 34 251.63
R 34 251.63	R 239.76	R 34 491.39
R 34 491.39	(c)	R 34 732.83
R 34 732.83	R 243.13	R 34 975.96
R 34 975.96	R 244.83	R 35 220.79
R 35 220.79	R 246.55	R 35 467.33
R 35 467.33	R 248.27	R 35 715.61

1. What type of interest is Mr Samad getting, simple or compound? How do you know this? (2)
- Compound interest. The interest changes all the time. (2)
2. Calculate the missing values (a) to (c) in the table. (5)
- a) R31282,25
- b) R32619,32
- c) R241,44

3. The table shows a portion of the investment for 25 months. Calculate the amount of interest, in rand, which Mr Samad received over that 25-month period. (3)

$$35715,61 - 30000 = R5715,61 \quad \checkmark a \quad (3)$$

4. Calculate the interest rate, as a percentage correct to one decimal place, which he is receiving per year. (4)

$$\begin{aligned} 32619,32 &= 30000(1+i)^1 \quad \checkmark \text{equation} \\ \frac{32619,32}{30000} &= 1+i \\ 0,08... - 1 &= i \quad \checkmark m \\ 0,087 \times 100 &= i \\ 8,7\% &= i \quad \checkmark a \end{aligned} \quad (4)$$

5. By means of trial and error, determine the approximate number of years it would take Mr Samad's investment to reach R45 000 by using your answer in question (b4). (4)

$$\begin{aligned} 1 \text{ year} &: 38822,86807 \\ 1 \text{ year} &: 42200,45759 \quad \checkmark m \\ A &= 42200,45759 \left(1 + \frac{8,7\%}{12}\right)^9 \\ &= 25 \text{ months} + 1 \text{ year} + 9 \text{ months} \quad \checkmark \text{adding} \quad (4) \\ &= \pm 5 \text{ years} \quad \checkmark a \end{aligned}$$

Arlene is Aliana's 65-year-old grandmother who earns a gross monthly salary of R35 000,00. Use the tables to answer the questions that follow.

Table 1: Tax bracket

Taxable income (R)	Rates of tax (R)
1 – 195 850	18% of taxable income
195 851 – 305 850	35 253 + 26% of taxable income above 195 850
305 851 – 423 300	63 853 + 31% of taxable income above 305 850
423 301 – 555 600	100 263 + 36% of taxable income above 423 300
555 601 – 708 310	A + 39% of taxable income above 555 600
708 311 – 1 500 000	207 448 + 41% of taxable income above 708 310
1 500 001 and above	532 041 + 45% of taxable income above 1 500 000

Table 2: Tax Rebates and Thresholds

Age	Tax Rebate	Age	Tax Threshold
Primary	R14 220	Under 65	R79 000
Secondary (65 and older)	R7 794	65 and older	R122 300
Tertiary (75 and older)	R2 601	75 and older	R136 750

Source: <http://www.sars.gov.za>

1. Determine the value of A in Table 1. (3)

$$\begin{aligned} 555600 - 423300 &= 132300 \quad \checkmark m \\ 132300 \times 36\% &= 47628 + 100263 \quad \checkmark \text{sub into equation} \\ &= R147891 \quad \checkmark a \end{aligned}$$

2. Arlene's Medical Aid comes to R2 300 per month of which she contributes a $\frac{1}{3}$ of the amount. Additional deductions per month include: Unemployment Insurance Fund at 1% of her gross salary, Pension Fund at 7% of her gross salary and donations amount to R500. Calculate her taxable income for the 2020 tax year (1 March 2020 - 28 February 2021). (6)

$$MA: 2300 \times \frac{1}{3} = R766,67 \quad \checkmark a$$

$$UIF: 35000 \times 1\% = R350 \quad \checkmark a$$

$$PF: 35000 \times 7\% = R2450 \quad \checkmark a \quad (6)$$

Donation: R500

$$TI = 35000 - 766,67 - 350 - 2450 - 500 \quad \checkmark -$$

$$= R30933,33 \times 12 \quad \checkmark x$$

$$= R371 199,96 \quad \checkmark a$$

3. Aliana's birthday gift from Arlene is dependent on how much tax Arlene must pay. Hence, determine her tax payable for the 2020 tax year. (4)

$$TP = 63853 + 31\%(371199,96 - 305850) = 14220 - 7794$$

$$= R62097,4876$$

$$= R62097,49 \quad \checkmark a \quad (4)$$

Question Two

[28]

- a. Aliana's mom Derushia will be baking brownies for the birthday party. She uses the following recipe:

American Brownies

183 calories for 16 servings



Ingredients

Brownie

$\frac{1}{2}$ cup melted butter	3 tablespoons softened butter
1 cup sugar	3 tablespoons cocoa powder
1 teaspoon vanilla	1 tablespoon honey
2 eggs	1 teaspoon vanilla extract
$\frac{1}{2}$ cup all-purpose flour	1 cup confectioners' sugar
$\frac{1}{3}$ cup cocoa powder	
$\frac{1}{4}$ teaspoon baking powder	
$\frac{1}{4}$ teaspoon salt	

Source: <https://www.food.com/recipe/best-brownies-with-frosting-99701>

The ingredients listed are enough for 16 servings, but Derushia would like to make 75 servings. She only has $2\frac{1}{2}$ blocks of butter in stock. Using the information above and the table below, determine whether the butter she has is sufficient for 75 brownies.

Butter:

1 tablespoon = 14 grams

$\frac{1}{2}$ cup = 113 grams

250 g = 1 block

(8)

$\frac{1}{2}$ cup	113 g	$\rightarrow$ 250g : 1 block
3 lbs	42 g	726,5625g : 2,91 blocks
Total	= 155g	
155g	16 servings	
726,5625g	75 servings	
No, it will not be sufficient		

- d. Mr Samad decides to have Aliana's birthday party at the Ridge on the Hill venue. Ridge on the Hill charges Mr Samad R500,00 including VAT (15%) for the water they are expected to use. The cost of the venue hire is separate from the water charge. Using table 3, calculate the number of kl that is expected to be used.

(8)

Table 3: The water tariff of eThekwinini for 2020

Prices per kilolitre excluding VAT	new
$0 < kl \leq 6$	nil
$6 < kl \leq 25$	R19.14
$25 < kl \leq 30$	R25.48
$30 < kl \leq 45$	R39.31
More than 45kl	R43.24

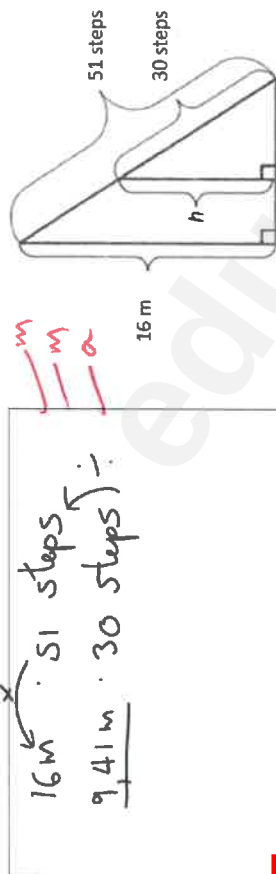
Source: <http://www.durban.gov.za>

OP = 500	kl x R0 = R0
115%	19 kl x R19,14 = R363,66
= R434,78	
kl = 71,12	434,78 - 363,66 = R71,12
25,48	
= 2,79	
Total = 6 + 19 + 2,79 = 27,79 kl	

$$\begin{aligned} \text{or } \frac{75}{16} &= 4,6875 \times 5 \\ 5 \times 155 &= 775 \\ 775 \div 250 &= 3,1 \text{ blocks} \end{aligned}$$

b. There are 51 steps leading to Ridge on the Hill.

1. Calculate how high above ground (h) is the 30th step.



2. The guests will burn calories as they climb up and down the steps as follows:

0.11 calories will be burnt climbing up every step.

1.2 calories will be burnt for every 20 steps down.

Using the above information, show that a guest will have to walk more than 2 times up and down the stairway to burn off the calories consumed from 2 servings of brownies.

188 cal : 16 servings	
12,875 cal : 2 servings	
0.11 cal x 51 = 5,61 cal	✓
Total = 8,67 cal	✓
# of times = $\frac{22,875}{8,67} = 2,64$ times	✓
	⑦

or * $8,67 \times 2 = 17,34$

∴ You need to exercise / walk up more than twice up & down steps.

c. Each table at the venue will have several cylindrical centrepieces.

The centrepieces will have to be transported to the venue in a

rectangular box with the dimensions $1,5 \text{ m} \times 0,60 \text{ m} \times 0,90 \text{ m}$.

Each centrepiece has a diameter of 12 cm and a height of 29 cm.

Aliana calculates the number of centrepieces that will fit into 1 box:

$$\text{Volume of centrepiece} = 3,14 \times 0,06^2 \times 0,29$$

$$= 0,00327816 \text{ m}^3$$

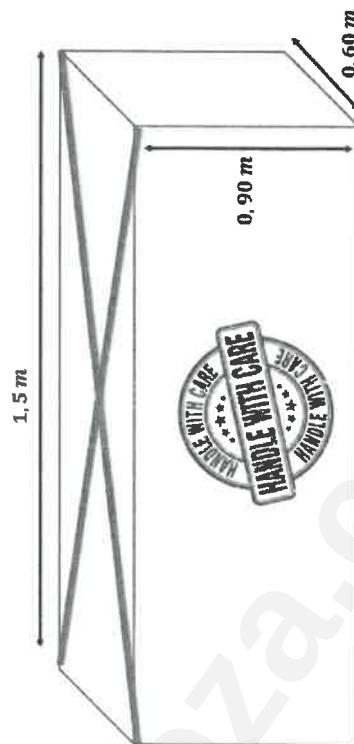
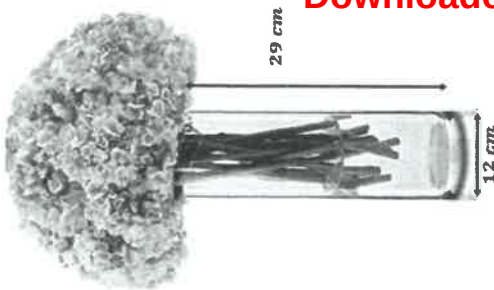
$$\text{Volume of box} = 1,5 \times 0,6 \times 0,9$$

$$= 0,81 \text{ m}^3$$

$$\text{Number of centrepieces} = 0,81 \div 0,00327816$$

$$= 247,089 \dots$$

$$\approx 247 \text{ centrepieces}$$



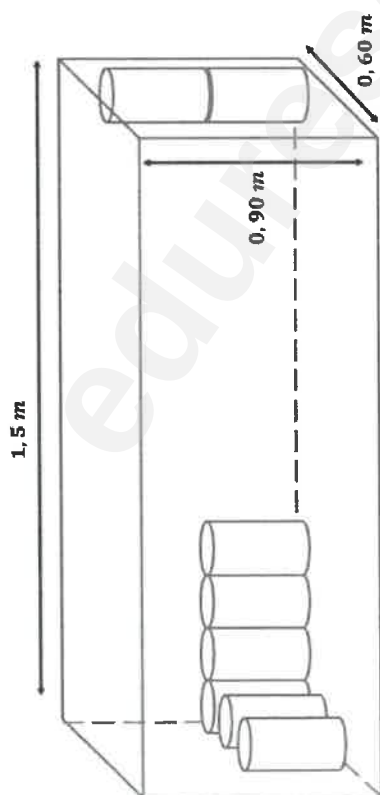
Caitlin, who is Aliana's aunt and a mathematical literacy teacher, recognises the common mistake that Aliana has made in calculating the number of centrepieces that can fit.

1. Explain, in words, what the mistake is.

(2)

You cannot fit a solid circular object into a solid space like how you would a liquid. You can't divide the volumes by each other. ②

2. Caitlin states that 180 centrepieces can fit into this box if the centrepieces are packed in the following way as illustrated in the diagram below. Is this statement True or False? Justify your answer with calculations. (8)



Note: the diagram is not drawn to scale and shows only a few of the centrepieces so that you may see how they are packed.

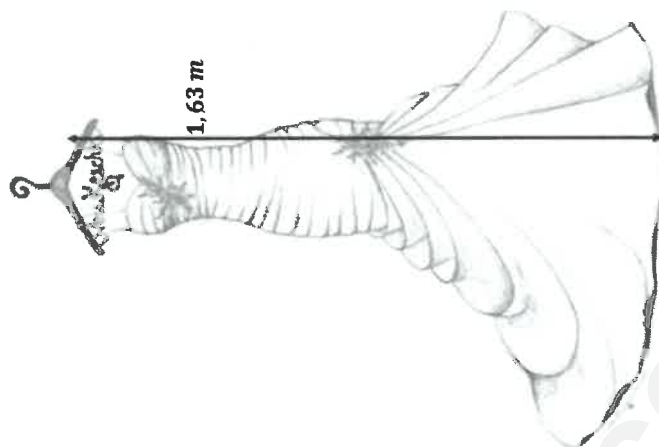
$\text{length} = 1,5 \div 0,12 = 12,5 \approx 12$ ✓
 $\text{height} = 0,9 \div 0,29 = 3,1 \approx 3$ ✓ rounded off
 $\text{width} = 0,6 \div 0,12 = 5$ ✓
 # of centre pieces = $12 \times 3 \times 5$ ✓
 $= 180$ ✓ a True ✓
 (8)

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Question Three

[24]

- a. Aliana designs a dress for her birthday party as shown in the drawing. Calculate the scale of the drawing in unit form correct to the nearest whole number. (4)



M R

11,6 cm : 1,63 m $\times 10^5 \checkmark$

11,6 cm : 1,63 cm $\checkmark$

1 : 14,05 - $\checkmark$

$\approx 1 : 14 \checkmark$

Dov



- b. Aliana also designs the shoe she wants to use for her birthday party. Using the scale of the drawing in question (3a), approximate the size of her shoe by calculating its length indicated by the dashed line. (4)

M . R
1 : 14 $\checkmark$ $\frac{con}{m}$
1,7 : 26,6
Size 8 $\checkmark$ $\frac{con}{4}$

include / need sizes

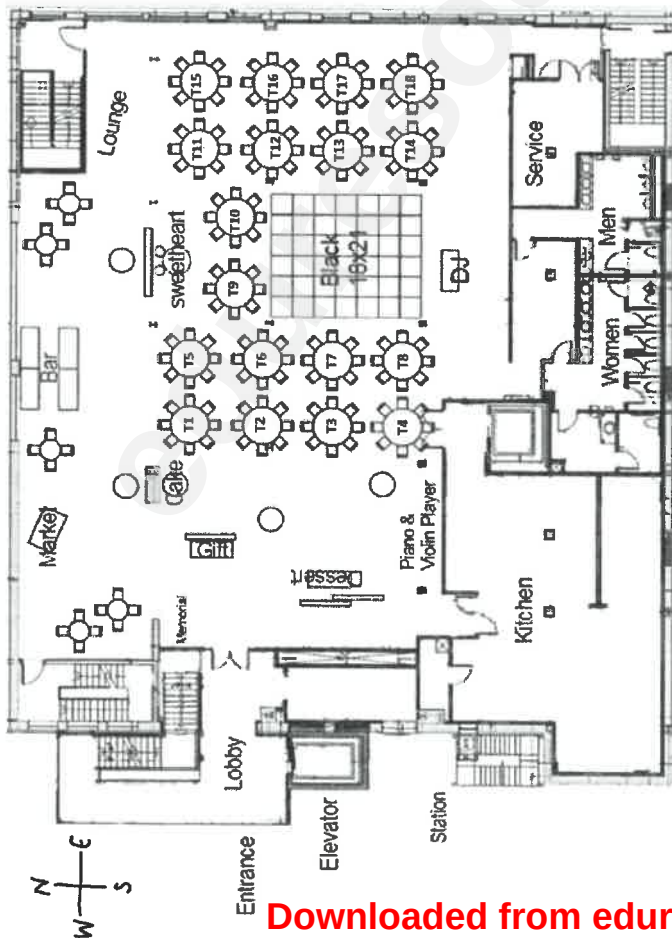
include/keep sizes above 8.

Table 4: Shoe sizes and measurement

Shoe size	4	4½	5	5½	6	6½	7	7½	8
<i>cm</i>	23.8	24.1	24.5	24.8	25.1	25.4	25.7	26	26.7

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- c. The diagram below is the floorplan of the Ridge on the Hill venue. Use the floorplan to answer the questions that follow:



1. A fly sits on the centre of table 1 (T1), it then flies 6 m to the centre of table 4 (T4), and then 8 m to sit on the centre of table 18 (T18). If the fly wants to fly directly to T1 from T18, calculate the distance it travels. Draw a rough sketch to assist your answer. (5)

Sketch	Calculation
	$x = \sqrt{6^2 + 9^2}$ $x = 10.8 \text{ m}$

2. Hence, determine the radius of one of the tables if the space between two tables' circumference is 0.5m. (3)

$6 - (0.5 \times 6) = 4.5$ $4.5 \div 6 = 0.75 \text{ m}$
--

3. Give directions from the men's toilet to the lounge. (3)

Walk North turn left, turn right, walk East, turn left, walk North to the lounge

- d. Aliana's best friend Zoe will be travelling from Richards Bay to Durban for the birthday party. The speed limit on the freeway is 120 km/h and it takes Zoe 45 minutes to travel from Richards Bay to Durban. State if Zoe is adhering to the speed limit. Use the distance chart below and calculations to justify your answer. (5)

Durban			
236	Ladysmith		
170	336	Richard's Bay	
356	422	195	Sodwana Bay
134	366	303	492
			Margate

170 km

$$S = 170 \div \frac{45}{60}$$

$$= 226.67 \text{ km/h}$$

No, the speed limit is 120 km/h

or $\frac{170}{120} = 1 \text{ h } 25 \text{ min}$
 : Too fast. Should have arrived at 1h 25 min not 45 min.

Question Four

- a. Aliana's grandfather, Allen, lives overseas and would like to travel to Durban for her birthday party. However, he has a fear of flying and researches the number of commercial plane crashes that have occurred world-wide in the last six months of 2019.

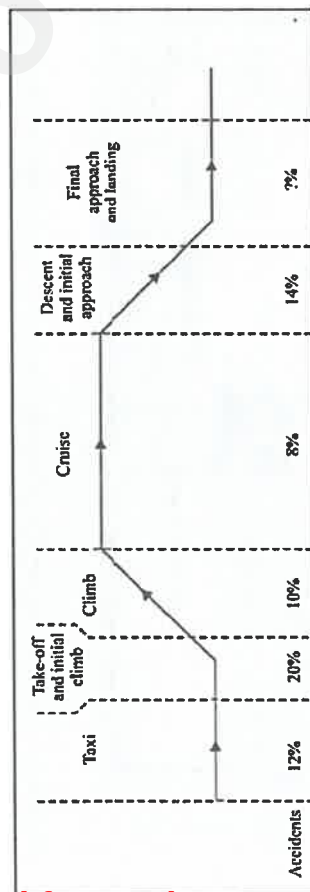
Table 5: The number of commercial plane crashes in the last six months of 2019.

Date	Location	Number of passengers killed
13 July	France	13
19 August	Sudan	62
22 August	Kenya	34
12 September	Russia	60
28 September	Nepal	60
27 November	Comoros	50
30 November	Congo	47
25 December	Myanmar	51
29 December	Russia	35

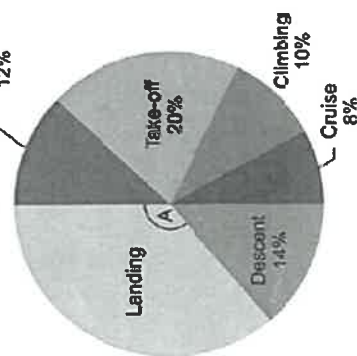
It is estimated that there were approximately 169 725 000 commercial planes that took off in the last half of 2019. Each of those flights carried a mean (average) of 70 passengers. Allen says he will never fly if the probability of being killed in a plane accident, in the last six months of 2019, is greater than 0,00006%. By means of calculations determine whether Allen will choose to fly or not. (5)

of passengers killed = 412
 Total passengers = $169725000 \times 70 = 11880750000$
 $P(\text{Flying}) = \frac{412}{11880750000} \times 100$
 $= 0,000003\%$
 ∴ He will fly

The accidents that do occur happen at various stages of the flight. The diagram and pie chart indicate the percentage of accidents that occur at various stages of a flight.



When do Accidents Occur?



or $0,00006\% \times 11880750000$
 $= 712,45$
 ≈ 7129 people
 ∴ less than 7129 people being killed by flights.

Allen calculated the number of accidents that occurred in 2019 during landing by 17 commercial planes. He performed the following calculation:

1. Show how Allen got $\frac{36}{100}$ as shown in his calculation above. (2)

$$\frac{36}{100} \times 17 = 6,12 \text{ accidents}$$

100 - 14 - 8 - 10 - 20 - 12 = 36
 $\therefore \frac{36}{100}$

2. Although Allen got the answer of '6,12 accidents', explain why this answer is not 100 percent correct. (2)

He should round up the answer as planes will be discrete data.

3. Calculate the size of the angle representing landing (Angle A) in the pie chart above to the nearest degree. (3)

$360 \times \frac{36}{100} = 129,6$
 $\approx 130^\circ$

c. Allen is still sceptical about traveling due to the countless number of infections that can be contracted from overcrowded places like the airport. He researches the number of passengers that flew from the world's 5 busiest airports during 2019.

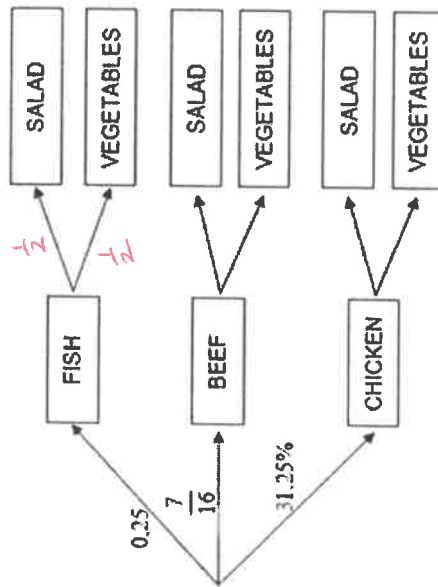
Table 6: The number of passengers from the world's 5 busiest airports during 2019

Rank	Airport	Location	Total passengers
1	Hartsfield-Jackson Atlanta International Airport	Atlanta, Georgia, United States	?
2	Beijing Capital International Airport	Chaoyang, Beijing, China	81 929 359
3	London Heathrow Airport	Hillingdon, London, United Kingdom	70 037 417
4	Tokyo International Airport	Ota, Tokyo, Japan	66 795 178
5	O'Hare International Airport	Chicago, Illinois, United States	66 733 503

Between these top 5 busiest airports, the mean (average) number of passengers passing through the gates were 72 150 914.6. Calculate how many passengers went through the boarding gates at Hartsfield-Jackson Atlanta International Airport. (3)

$$\begin{aligned} 72150914.6 &= x + 81929359 + 5 + 66733503 \\ 360754513 &= x + 285495451 \\ 75259116 &= x \end{aligned}$$

Allen is very fussy when it comes to food. He thinks of the typical airline menu and the various combinations he can order when travelling. The airline menu typically includes chicken, beef and fish with either salad or vegetable combination with each meal. See the tree diagram below.



1. Show that there were 35 beef dishes if the airline had only 80 meals (one meal per passenger). (2)

$$\frac{7}{16} \times 80 = 35$$

2. In the question, "What is the probability that a passenger would order the chicken and a salad, presuming there were the same number of salads and vegetables available?" These were the following responses of Allen and Aliana:

Allen answer: $(31.25\% \times 80) + \frac{40}{100} = 25.4\%$

Aliana answer: $\left(\frac{31.25}{100} \times 80\right) \times \frac{1}{2} = 50$

i. Circle the correct statement.

- A Both Allen and Aliana had the correct answers.
- ☒ B Both Allen and Aliana had incorrect answers. ✓ a
- C Allen had the correct answer whereas Aliana had the incorrect answer.
- D Aliana had the correct answer whereas Allen had the incorrect answer.

ii. If there was an option of cheesecake, apple crumble, chocolate mousse or bar one cake for dessert. What is the probability of choosing beef with vegetable and bar-one cake? (4)

$$\begin{aligned} P(B \cap V \cap B_1) &= \frac{7}{16} \times \frac{1}{2} \times \frac{1}{4} \times 100 \\ &= 5.47\% \end{aligned}$$

Question Five

Use the table below to answer the questions that follow.

Table 7: Showing distance local guests must travel to attend Aliana's birthday party

Class Interval (km)	Frequency	Cumulative Frequency
$5 \leq k < 10$	12	12
$10 \leq k < 15$	A: 5	17
$15 \leq k < 20$	B: 8	25
$20 \leq k < 25$	10	C: 35
$25 \leq k < 30$	7	42
$30 \leq k < 35$	3	45
$35 \leq k < 40$	1	D: 46

a. Fill in the missing values in the above table. (4)

FORMULAE SHEET:

$$\text{Old Price} = \frac{\text{New Price}}{100\% \pm \%}$$

$$\text{Percentage change} = \frac{\text{New Price} - \text{Old Price}}{\text{Old Price}} \times 100\%$$

$$a^2 = b^2 + c^2$$

$$\text{Circumference} = 2\pi r$$

$$\text{Area}_{\text{rectangle}} = l \times b$$

$$\text{Area}_{\text{triangle}} = \frac{1}{2} \times b \times h$$

$$\text{Area}_{\text{circle}} = \pi r^2$$

$$\text{Volume} = \text{base area} \times \text{height}$$

$$A = P(1 + i \times n)$$

$$A = P(1 + i)^n$$

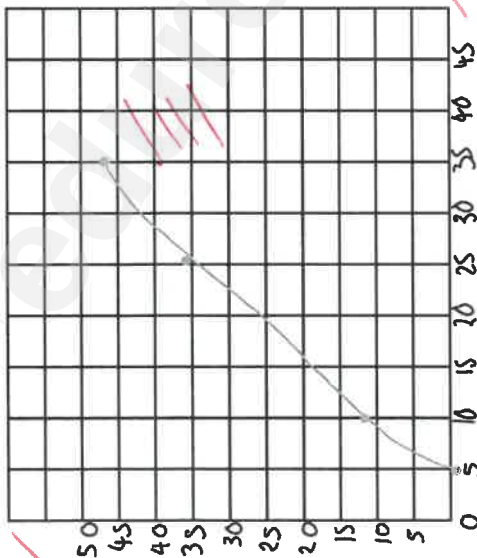
- b. State if the above data is qualitative or quantitative; and if appropriate, discrete, or continuous.

(2)

Quantitative, continuous

- c. Represent the data as an Ogive on the set of axes below.

(6)



Class Intervals (km)

- d. Aliana claims that 40 guests fall in the 40th percentile. Is this an accurate claim? Use the Ogive and calculations to justify your answer.

(5)

46 x 40% = 18,4
 ≈ 18 guests
 She is not accurate

- e. Use the Ogive and calculations to determine the interquartile range.

(6)

Q₁ 46 x 25% = 11,5 → 10
 Q₃ 46 x 75% = 34,5 → 35
 IQR = 35 - 10 = 25

END OF PAPER

TOTAL: 150 MARKS