

1. The following questions deal with investments that Ms. A has recently made, in order to start saving for her retirement. The compound interest formula is given as  $FV = PV \left(1 + \frac{r}{n}\right)^{nt}$ .

**(8 marks)**

- |   |   |
|---|---|
| <p>a. On January 1<sup>st</sup> 2015, Ms. A invested \$20,000 into an investment that earns 7% p.a., compounded quarterly. Ms. A would like to know the future value of this investment in 10½ years. Show/explain the analysis that leads to your final answer.</p> <p>(4)</p> | <p>b. Today, she will invest some additional money so that she can purchase a house. The investment will earn 5% interest, compounded monthly. If she needs the investment to be worth \$45,000 in 9 years, how much should she invest today? Show/explain the analysis that leads to your answer.</p> <p>(4)</p> |
|---|---|

2. Amin has become a world famous medical researcher who has developed a medicine to cure MATHITIS. Once the medicine is taken, it is used up as it kills the bacteria that cause MATHITIS. The mathematical model  $A(t) = 50(0.85)^{\frac{t}{8}}$  can be used to describe the amount of medicine still left in the body, where t is the time in hours since the dose was taken and A(t) is the amount of medicine left in the body measured in milligrams. Therefore a new dose of medicine is required every 8 hours.

**(10 marks)**

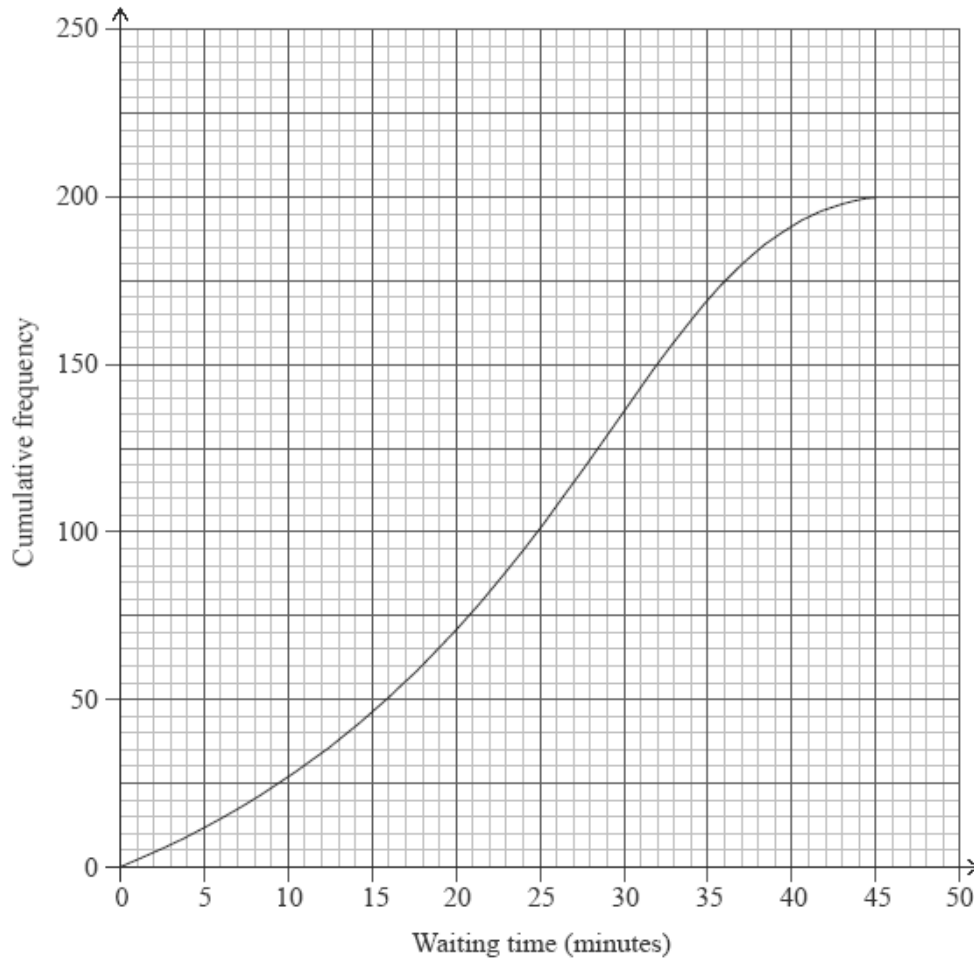
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|--|--|
| <p>a. Given the equation used to model this problem, what is the amount of the initial dose taken by a patient?</p> <p>(1)</p>   | <p>b. Explain what the point (3, 30.7) means in the context of this question.</p> <p>(2)</p>                                 |
| <p>c. How long does it take for HALF the medicine to get used up in the body? Show/explain your solution. (Round answer to the nearest tenth of an hour)</p> <p>(3)</p>  | <p>d. How much of the medicine is still in a patient’s body after 8 hours (BEFORE they take their next dose?)</p> <p>(2)</p> |
| <p>e. A patient takes the second dose exactly at 8 hours. Now another 4 hours passes. How much of the medicine remains in the body after this 12 hour time period? Show/explain the analysis that leads to your answer.</p> <p>(2)</p> |  |

3. The following questions are either TRUE or FALSE. You are required to decide whether or not the statements are T (True) or F (False) and then provide a reason for your answer.

**(4M)**

- a. It is not possible to have a parabola with only 1 x-intercept
- b. If the zeroes of a parabola are  $x = -3$  and  $x = -9$ , then the parabola must have a maximum point.

4. The cumulative frequency graph shows the amount of time in minutes, 200 students spend waiting for their train on a particular morning.



Use the graph to:

- |  |  |
|--|--|
| <p>a. Write down the median waiting time.</p> <p style="text-align: right;"><b>(1)</b></p>                                   | <p>b. Write down an estimate for Q1 and for Q3.</p> <p style="text-align: right;"><b>(2)</b></p>   |
| <p>c. Find the percentage of time students waited for more than 37 minutes.</p> <p style="text-align: right;"><b>(2)</b></p> | <p>d. Find the value of <math>m</math> if 57.5% of the time students waited for less than <math>m</math> minutes.</p> <p style="text-align: right;"><b>(2)</b></p> |

5. In the year 2030, Shivani has become a leading industrial entrepreneur (working for the Tata Group) in India and due to her awesomeness, the company's profit starts to increase, according to the equation  $D = 150(1.0955)^t$ , where  $D$  represents the annual profit, in billions of US dollars and  $t$  represents the years since 2030.

**(9 marks)**

- a. Write the number 150 billion in scientific notation. (1)
- b. At what yearly rate does the Tata's Group profits increase? (1)
- c. What is the company's expected profit in 2050 (answer in billions of dollars)? (2)
- d. In what year will Tata Group's profits be \$200 billion? Show/explain your solution. (Give your final answer rounded to the nearest tenth of a year.) Show/explain the analysis that leads to your answer. (3)
- e. Shivani introduces some new changes to the way the company operates. As a result, the company's yearly rate changes. Shivani notices that the profits have increased from \$150 billion to \$225 billion in 5 years. Determine the company's new annual rate of growth. (2)

6. Kelly scored the following on 5 science tests during second semester: 73%, 89%, 94%, 87%, 82%.

- a. What is the next test score Kelly must get to have an 85% test average in science? (2)
- b. What is Kelly's maximum possible test average in science? (2)

Let's say Kelly scored 95% on Test #6. Now Kelly's semester grade is 86.7%. In Science, the final exam is weighted 20% of the overall grade and the semester grades are weighted 80% of the overall grade. Kelly's personal goal for second semester is to earn **at least** a B+ in Science.

- c. Is it possible for Kelly to get an A- (90%) in Science? (2)

7. The population of Mathsville is modeled by the equation  $P(t) = 6t^2 + 110t + 3000$ , where  $P$  is the population in thousands and  $t$  is time in years **since 2000**. The population of Functions City is modeled by the equation  $F(t) = 12t^2 - 200t + 4000$ , where  $F$  is the population in thousands and  $t$  is time in years **since 2000**

- a. You may want to use the TI-84 to prepare a graph to help answer this question. Record your window settings below and briefly explain WHY you selected these settings. (HINT: READ THE QUESTION FIRST!!!!)

**(3M)**

Xmin	Xmax	Ymin	Ymax

- b. Mathsville was founded in 1950. What was the population of Mathsville that year?
- c. In what year were the populations equal?

**(1M)**

**(1M)**

- d. Is the population of Functions City increasing or decreasing in 1976? Show/Explain how you determined your answer.
- e. Which town's population is rising the fastest? Explain how you determined your answer.

**(2M)**

**(2M)**

8. You are given the quadratic equation  $f(x) = -8x^2 - 16x + 504$ , which you are being asked to factor and then solve for  $f(x) = 0$ . You **MAY** use your graphing calculator to graph the parabola and then answer the following questions IN ANY ORDER YOU WISH:

- a. Solve the equation  $0 = -8x^2 - 16x + 504$ . Show your work **OR** explain how you used the graph and/or the graphing calculator to help you solve the equation.
- b. Factor  $f(x) = -8x^2 - 16x + 504$ . Explain how you can use your answer to question (a) to help you factor the equation.

**(3M)**

**(2M)**

9. The table below shows the frequency distribution of the number of dental fillings for a group of 250 American children.

Number of fillings	0	1	2	3	4	5
Frequency	40	30	50	$q$	40	10

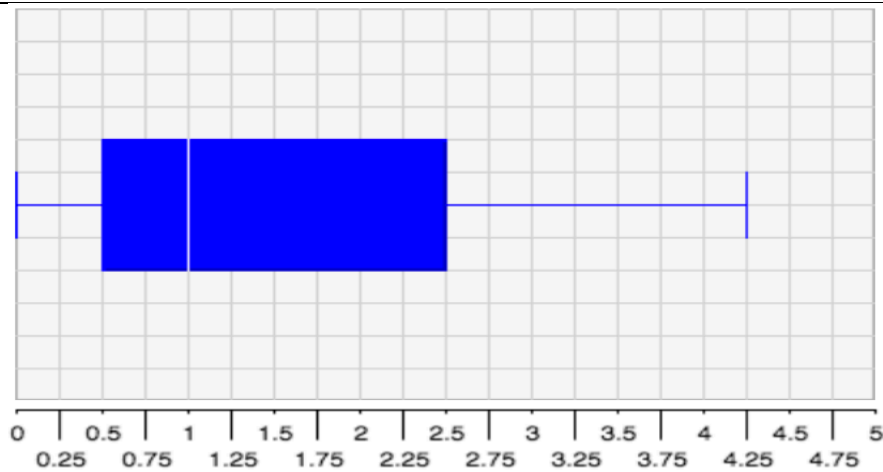
a. Explain why the value of  $q$  is 80. (2)

b. Is this data an example of discrete data or continuous data? Explain your reasoning. (2)

c. Use your calculator to find:

(i) the mean number of fillings                      (ii) the median number of fillings                      (iii) the mode number of fillings (3)

d. The following box and whisker plot showing statistical information about the number of dental fillings for a group of **250 Egyptian children**.



Number of Fillings in Egyptian Children

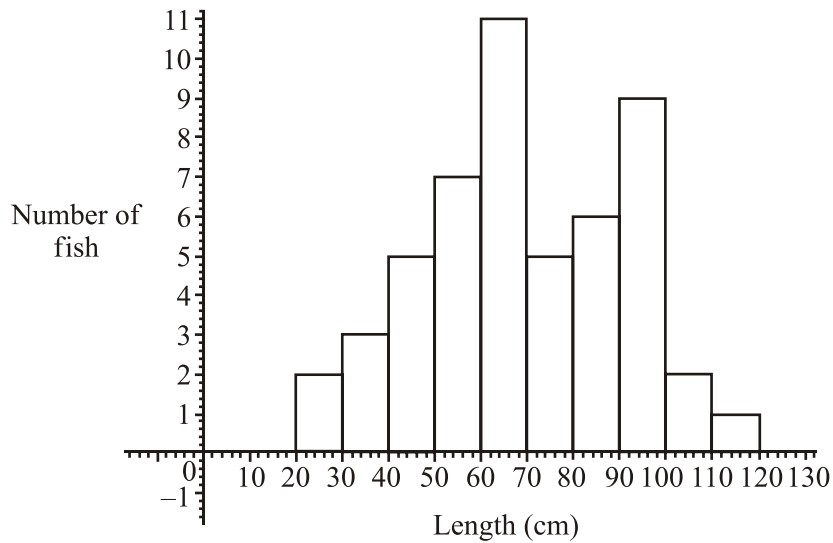
List one thought/observation about the number of fillings in American and another one for the Egyptian children

List one question you may have about the data presented

Which group (American or Egyptian) seems to have more fillings? Explain your reasoning

(3)

10. The figure below shows the lengths in centimeters of fish found in the net of a small trawler.



a. Find the total number of fish in the net.

(2)

b. Find

- i. the modal length interval;
- ii. the interval containing the median length;
- iii. an estimate of the mean length.

(5)

The fishing company must pay a fine if more than 10% of the catch have lengths less than 40cm.

c. Will the company be fined? Show your calculations to back up your answer.

(1)

11. Mr. S is taking some ANTI-MATH medicine. Unfortunately, this medicine has an affect on his memory if he takes too much. To help him with his dosage, Mr. S only has a couple of pieces of information. On Sunday, Mr. S took

his initial amount of medicine. On Monday the amount in his body was 67.5 mg. On Wednesday he had 50.625 mg in his body.

- a. Create a data table to help you organize the given information.

Sun	Mon	Tues	Wed	Thurs

- b. Use the information that you just organized to create an equation to model the amount of medicine in Mr. S’s body. Define your variables (what will x and y represent?)

X will represent →

Y will represent →

- c. Mr. S was only supposed to take a maximum dose of 80 mg of medicine on Sunday. Did Mr. S take too much? Explain how you determined your answer.

Mr. S needs to retake his medicine when the amount drops below 10 mg.

- d. When should he take his next dose? Explain/show how you determined your answer.

- e. How much should he take so that he doesn’t overdose and affect his memory?

12. Mr. Santowski’s family has been running a summer sports camp for the past 75 years. The revenue received per year is modeled by the quadratic function  $R(t) = 7t^2 + 150t + 5,000$ , where  $t$  is time in years since 2000 (so  $t = 0$  represents the year 2000 and then  $t = 3$  represents the year 2003 and  $t = -4$  would represent the year 1996)

- a. What will the revenue be in 2008? BRIEFLY explain/show how you determined your answer.

**(2M)**

- b. What was the revenue in 1991? BRIEFLY explain/show how you determined your answer.

**(2M)**

- c. In which year(s) was the revenue \$7,808? BRIEFLY explain/show how you determined your answer.

**(3M)**

- d. Determine the year in which the revenue was the least. BRIEFLY explain/show how you determined your answer.

**(2M)**

- e. Would this model (the given quadratic equation) be a good model to use in predicting his revenue from his clinics in the year 2050? Explain your reasoning.

**(2M)**

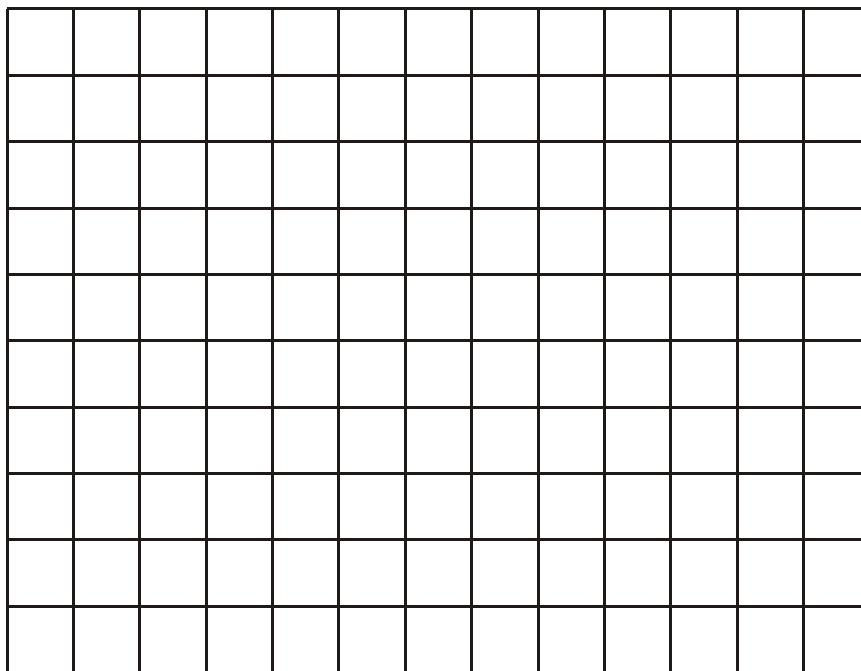
13. A random sample of 167 people who own mobile phones was used to collect data on the amount of time

they spent per day using their phones. The results are displayed in the table below.

Time spent per day ( $t$ minutes)	$0 \leq t < 15$	$15 \leq t < 30$	$30 \leq t < 45$	$45 \leq t < 60$	$60 \leq t < 75$	$75 \leq t < 90$
Number of people	21	32	35	41	27	11

- a. Draw a fully labeled histogram to represent the data.

(4)



- b. State the modal group.

(1)

- c. Use your calculator to calculate approximate values of the mean and median of the time spent per day on these mobile phones.

(2)

- d. If there are 250,783 people in the town where the sample was taken, approximately how many people in this town spend at least 45 minutes on their mobile phones?

(3)



14. The local council has been monitoring the number of cars parked near a supermarket on an hourly basis. The results are displayed below.

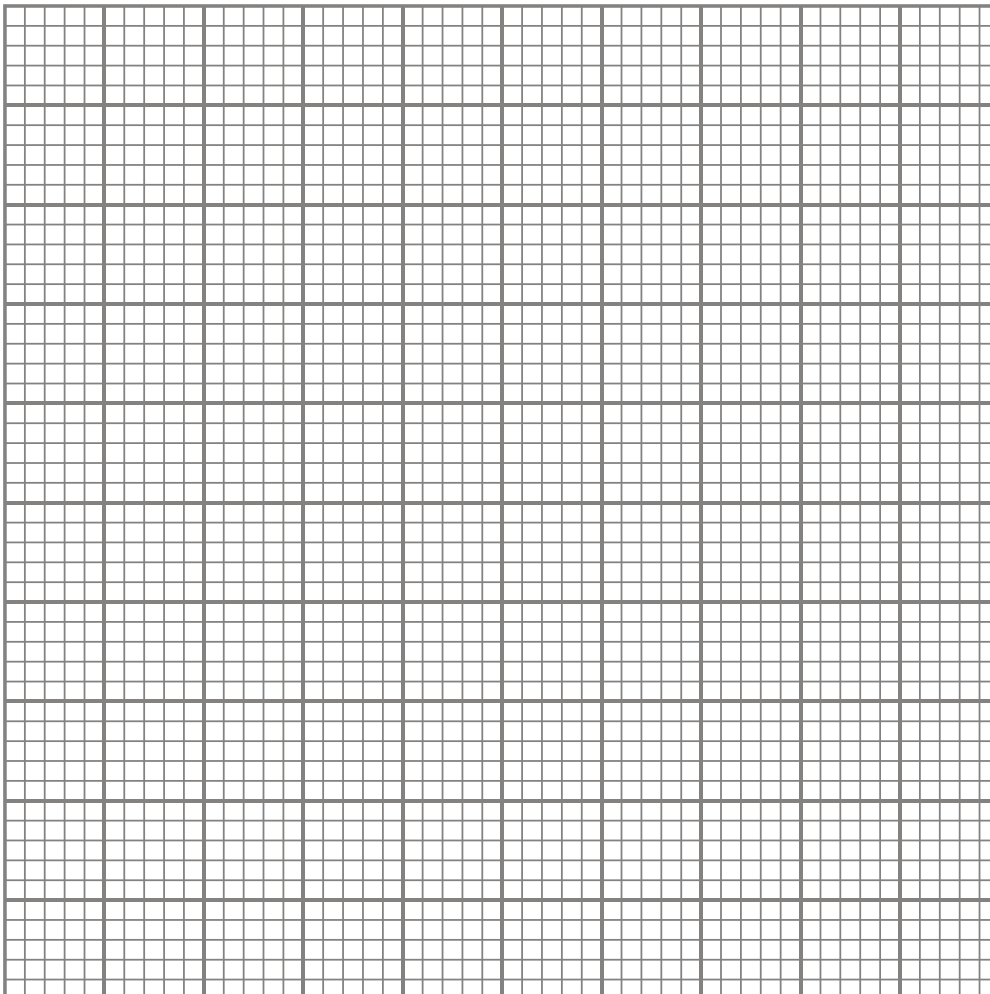
Parked Cars/Hour	Frequency	Cumulative Frequency
0–19	3	3
20–39	15	18
40–59	25	$w$
60–79	35	78
80–99	17	95

a. Write down the value of  $w$ .

(1)

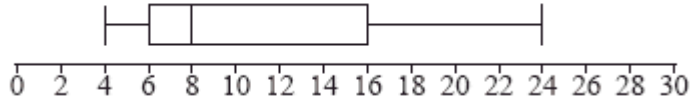
b. Draw and label the **Cumulative Frequency** graph for this data.

(4)

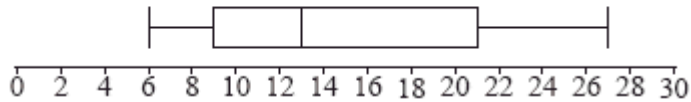


15. A scientist has 100 female fish and 100 male fish. She measures their lengths to the nearest cm. These are shown in the following box and whisker diagrams.

Female fish

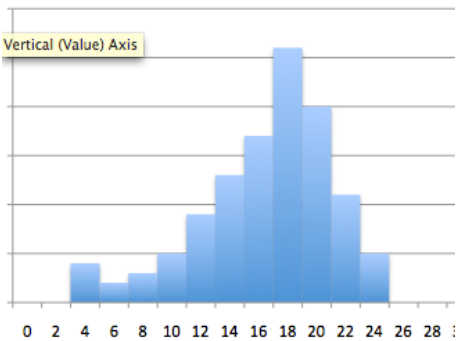


Male fish

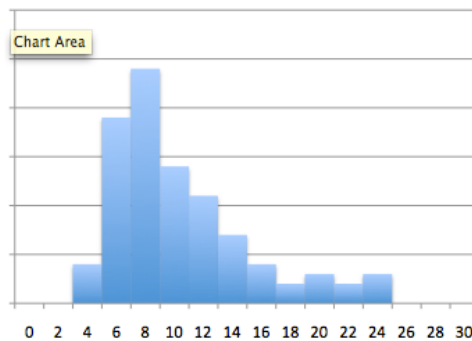


- |  |   |
|--|---|
| <p>a. Write down the median length of the female fish.</p> <p style="text-align: right;"><b>(1)</b></p>  | <p>b. Write down the median length of the male fish.</p> <p style="text-align: right;"><b>(1)</b></p> |
| <p>c. Find the interquartile range of the female fish.</p> <p style="text-align: right;"><b>(2)</b></p>  | <p>d. Find the interquartile range of the male fish.</p> <p style="text-align: right;"><b>(2)</b></p> |
| <p>e. Make a conclusion about the lengths of female and male fish.</p> <p style="text-align: right;"><b>(2)</b></p>  |   |
| <p>f. Find the range of the lengths of all 200 fish.</p> <p style="text-align: right;"><b>(2)</b></p>  |   |
| <p>g. Here are three plots that COULD represent the box &amp; whisker pots for the <b>female fish</b>. Select one and explain your reasoning.</p> <p style="text-align: right;"><b>(2)</b></p> |   |

PLOT (A)



PLOT (B)



PLOT (C)

