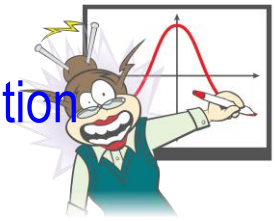
QCE Mathematical Methods Examination Preparation using TI-84 Plus Technology



Author:

Each of the questions included here can be solved using the TI-84 + technology.

Question 1

Taken from the 2020 Mathematical Methods Sample Paper, Multiple Choice section:

A population of bacteria after *t* hours is given by $P(t) = 5000e^{0.18t}$. The rate of increase of the population (to the nearest unit) at 15 minutes is:

a) 74 399 bacteria/hour
b) 13 392 bacteria/hour
c) 5 230 bacteria/hour
d) 941 bacteria/hour

Response:

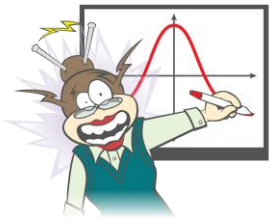
Question 2

Taken from the 2020 Mathematical Methods Sample Paper, Multiple Choice Section:

Using the trapezoidal rule with four sections, the approximate area under the curve $y = x^2 + 5$ between $x = 0$ and $x = 2$ is:

a) 12.67 units^2
b) 12.75 units^2
c) 13.00 units^2
d) 13.75 units^2

Response:



Question 3

Taken from the 2020 Mathematical Methods Sample Paper, Multiple Choice section:

The area of the region enclosed by the graphs of $y = x\sqrt{x+1}$ and $y = 2x$ is:

a) 1.276 units^2
b) 0.467 units^2
c) 0.200 units^2
d) 0.029 units^2

Response:

Question 4

Taken from the 2020 Mathematical Methods Sample Paper, Multiple Choice Section

The birth mass of babies is normally distributed with a mean of 3500 grams and a standard deviation of 500 grams. The probability that the birth mass of a baby is less than 3200 grams is:

a) 0.01
b) 0.06
c) 0.22
d) 0.27

Response:

Question 5

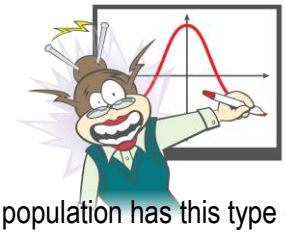
Taken from the 2020 Mathematical Methods Sample Paper, Multiple Choice Section.

A survey found that 142 of 200 people aged 30 to 39 have some form of tertiary qualification. The approximate 95% confidence interval for the proportion of people aged 30 to 39 who have some form of tertiary qualification for this survey is:

a. (0.62, 0.80)
b. (0.63, 0.79)
c. (0.65, 0.77)
d. (0.66, 0.76)

Response:

Question 6



Taken from the 2020 Mathematical Methods Sample Paper, Extended response section

People with type O negative blood are said to be 'universal donors'. In Australia, 9% of the population has this type of blood.
On a given day, a random group of 45 people volunteer to give blood.

a. Identify why this context is suitable for modelling as a binomial distribution
b. Determine the mean and the standard deviation of the number of people who are universal donors.
c. Determine the probability that no more than 3 of the donors are universal donors.

Response:

Question 7

Taken from the 2020 Mathematical Methods Sample Paper, Extended response section

During one 30-day period the rate at which pollution passes into a nearby lake is measured every six days and the results are given in the table below.

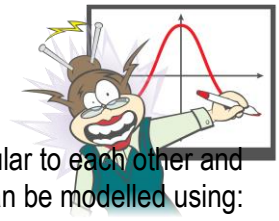
Day (t)	0	6	12	18	24	30
Rate of pollution in units per day $p(t)$	7	8	10	13	17	22

This information can be modelled as a quadratic function.

Determine the total amount of pollution entering the lake during this 30-day period.

Response:

Question 8



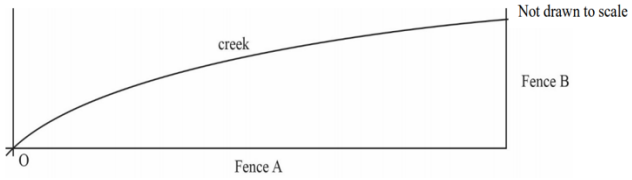
Taken from the 2020 Mathematical Methods Sample Paper, Extended response section

A farmer has a paddock with straight fences on two sides (fence A and fence B) perpendicular to each other and bounded by a creek on the other side. Fence B is 4 kilometers long. The creek boundary can be modelled using:

$$d = \ln(5x + e) - 1$$

Where d is the perpendicular distance in kilometres from fence A to the creek and x is the distance in kilometers along fence A from the point O.

The farmer wants to divide his paddock area in half with a straight fence, parallel to fence B.



Determine where the farmer should locate the fence.

Response:

Question 9

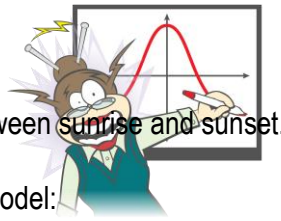
Taken from the 2020 Mathematical Methods Sample Paper, Extended response section

Suppose the proportion of Australians who supported the removal of single-use plastic bags from supermarkets is 64%.

a. Using the normal approximation, determine the probability that, in a randomly selected sample of size 100, more than 70% of those surveyed supported the removal of the single-use plastic bags.
b. Determine the size of the sample required for the survey to achieve a margin of error of 4% in an approximate 95% confidence internal for this population.
c. Identify the effect that halving the margin of error has on the sample size obtained in (b).
d. Determine the probability that in a randomly selected sample size of 25, the same proportion is equal to the population proportion.

Response:

Question 10



The number of hours of daylight in a day (n) is defined as the interval of time (in hours) between sunrise and sunset.

The number of hours of daylight in a day in Brisbane (B_n) can be approximated using the model:

$B_n = 1.73\cos\left(\frac{\pi}{183}t\right) + 12.13$ where *t* represents the number of days from 1 January.

The number of hours of daylight in a day in Oslo (O_n) can be approximated using the model:

$O_n = -6.61\cos\left(\frac{\pi}{183}t + 0.16\right) + 12.36$ where *t* represents the number of days from 1 January.

a. Determine the maximum number of hours of daylight in a day in Brisbane.
b. Determine the minimum number of hours of daylight in a day in Oslo.
c. Determine the number of days from January 1 (t), when the number of hours of daylight in a day in approximately the same in *both* cities. Give the answer to the nearest day.

Response: