



Course Methods Year 12 test three 2022

Student name: _____ Teacher name: _____

Task type: Response

Time allowed for this task: 40 mins

Number of questions: 6

Materials required: Upto 3 calculators/classpads allowed

Standard items:

Pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items:

Drawing instruments, templates, one page of A4 notes doubled

Marks available:

43 marks

Task weighting:

10 %

Formula sheet provided: Yes

Note: All part questions worth more than 2 marks require working to obtain full marks.

Q1 (3, 3 & 2 = 8 marks) (3.3.1)

Consider the discrete random variable X and the table of probabilities below.

X	0	1	2	3	4
$P(X = x)$	0.2	a	0.3	b	0.25

a) Given that the expected value of X is 2.15, determine the values of a & b .

b) Determine the standard deviation of X to 3 dp, showing all reasoning.

c) Determine the $E(3X + 4)$ and $\text{Variance}(3X + 4)$.

Q2 (3, 2, 1 & 3 = 9 marks) (3.3.3)

The number of X minutes late a train arrives at a particular station is a uniform probability distribution from 5 mins to 25 mins.

a) Sketch the probability density function for X showing all relevant features and labels.

Continued on next page for Q6b

b) Using (a) above and **without the use of a classpad**, show how to evaluate $\int 3 \ln(3x+1) dx$.

Hint-use $\frac{3x}{3x+1} = 1 - \frac{1}{3x+1}$

Q2 continued
b) Determine the probability that the train will be less than 12 mins late given that it is at least 7 mins late.

c) Determine the mean number of minutes late.

d) Determine the standard deviation of X showing all reasoning.

Q3 (3, 3 & 2 = 8 marks) (3.3.1)
Consider a game where two ordinary dice are thrown into the air and then land and the sum of the two top numbers is added. If the sum is a prime number (2, 3, 5, 7,) etc then this is considered a win.
a) Determine the probability of a win. Show reasoning.

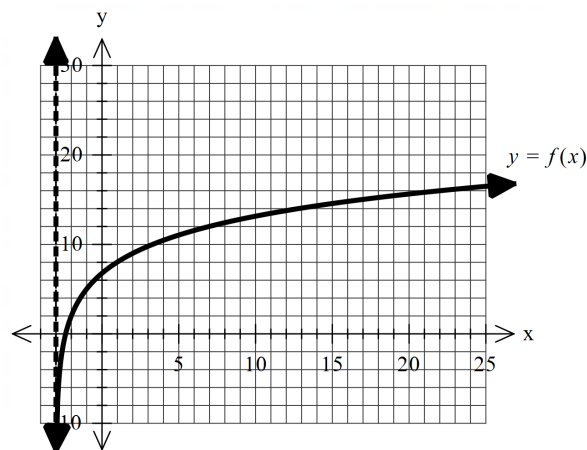
b) If this game was played 10 times, determine the probability that a win occurs at least 7 times. Show all reasoning.

Q3 cont-

- c) Let X = sum of the top numbers of both dice. Determine the mean and standard deviation for X .

Q4) (5 marks) (4.1.6)

Consider $f(x) = r \log_5(x+p) + q$ where r, p & q are constants.



Using the graph above and given that the following points

$(22, 16)$ & $(2, 9)$ lie on the curve $y = f(x)$, determine the values of r, p & q .

Q5 (2, 2 & 2 = 6 marks) (4.2.2)

Consider the probability density function $f(x) = ax^3(x-5)$, $1 \leq x \leq 5$ and zero for all other values of x .

- a) Show that $a = -\frac{5}{776}$.

- b) Determine the probability $\Pr(X \leq 3 | 2 \leq X \leq 4)$ for the above function.

- c) Determine the median.

Q6 (2 & 5 = 7 marks) (4.1.11)

- a) Show **without the use of a classpad** how to $\frac{d}{dx} [5x \ln(3x+1)]$.