PERTH MODERN SCHOOL
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Independent Public School

# 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 doublesided**

**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 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.

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.

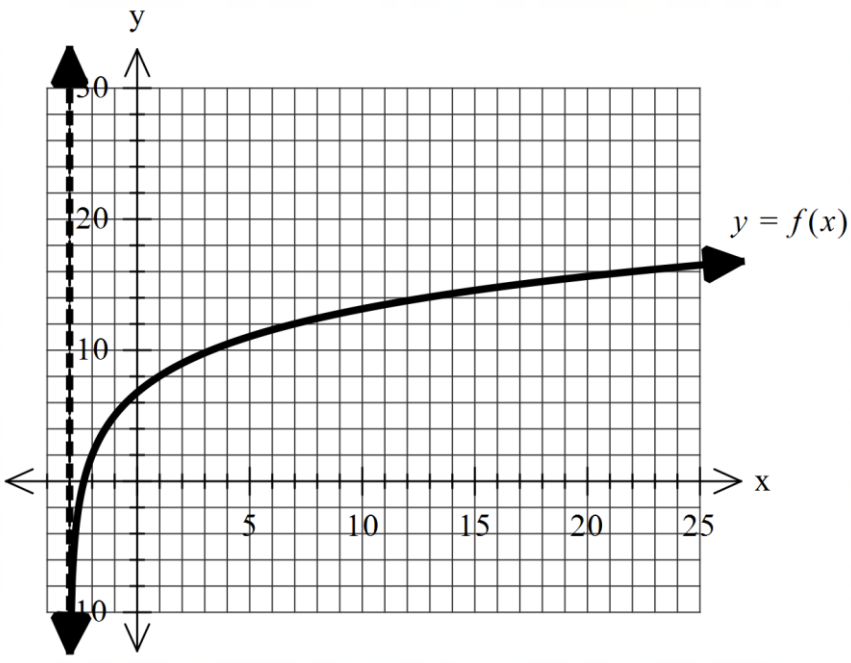
b) If this game was played 10 times, determine the probability that a win occurs at least 7 times. Show all reasoning.

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 $f(x) = ax^3(x-5)$ $,1 \le x \le 5$ and zero for all other values of $x$.

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

b) Determine the probability $\Pr(X \le 3 | 2 \le X \le 4)$ 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 $\frac{d}{dx}\left[5x\ln(3x+1)\right]$.

Continued on next page for Q6b

b) Using (a) above and **without the use of a classpad**, show how to evaluate $\int_0^1 3\ln(3x+1)\,dx$.

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

Q6 continued