NAME:_____ **Paper Preview 4: Probability** **DATE: 02/02/16**

19.) In any given season, a soccer team plays 65 % of their games at home.
When the team plays at home, they win 83 % of their games.
When they play away from home, they win 26 % of their games.

The team plays one game.

(a) Find the probability that the team wins the game.

(4)

(b) If the team does not win the game, find the probability that the game was played at home.

(4)

(Total 8 marks)

16.) The letters of the word PROBABILITY are written on 11 cards as shown below.

P	R	O	B	A	B	I	L	I	T	Y

Two cards are drawn at random without replacement.
Let A be the event the first card drawn is the letter A.
Let B be the event the second card drawn is the letter B.

(a) Find $P(A)$.

(1)

(b) Find $P(B \mid A)$.

(2)

(c) Find $P(A \cap B)$.

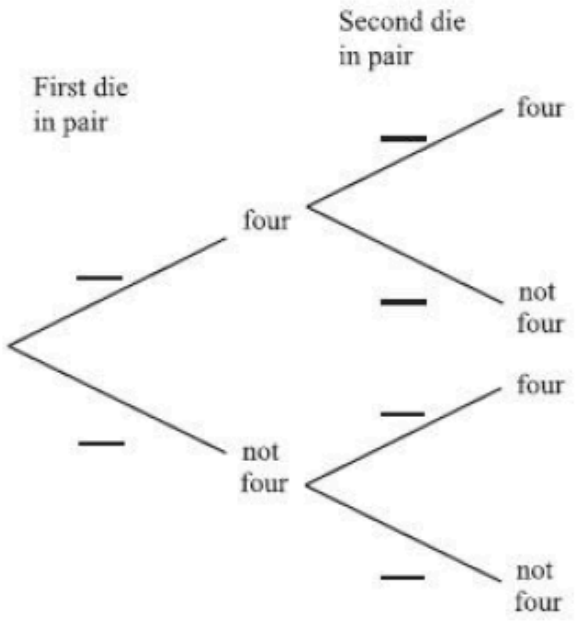
(3)

(Total 6 marks)

Can you draw a histogram? Can you interpret a cumulative frequency diagram?

48.) A pair of fair dice is thrown.

(a) Copy and complete the tree diagram below, which shows the possible outcomes.



(3)

Let E be the event that **exactly** one four occurs when the pair of dice is thrown.

(b) Calculate P(E).

(3)

The pair of dice is now thrown five times.

(c) Calculate the probability that event E occurs **exactly** three times in the five throws.

(3)

(d) Calculate the probability that event E occurs **at least** three times in the five throws.

(3)

(Total 12 marks)

18.) A random variable X is distributed normally with mean 450 and standard deviation 20.

(a) Find P($X \leq 475$).

(2)

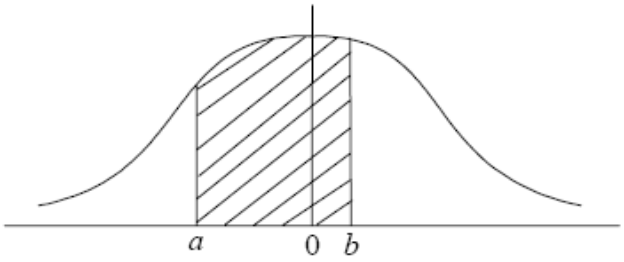
(b) Given that P($X > a$) = 0.27, find a.

(4)

(Total 6 marks)

(i) Reaction times of human beings are normally distributed with a mean of 0.76 seconds and a standard deviation of 0.06 seconds.

(a) The graph below is that of the **standard** normal curve. The shaded area represents the probability that the reaction time of a person chosen at random is between 0.70 and 0.79 seconds.



(i) Write down the value of a and of b.

(ii) Calculate the probability that the reaction time of a person chosen at random is

(a) greater than 0.70 seconds;

(b) between 0.70 and 0.79 seconds. *[6 marks]*

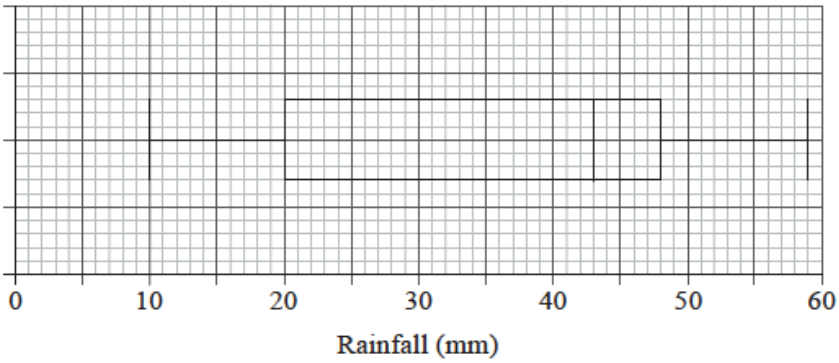
[Maximum mark: 6]

A random variable X is distributed normally with a mean of 100 and a variance of 100.

(a) Find the value of X that is 1.12 standard deviations **above** the mean. *[4 marks]*

(b) Find the value of X that is 1.12 standard deviations **below** the mean. *[2 marks]*

5. The distribution of rainfall in a town over 80 days is displayed on the following box-and-whisker diagram.



(a) Write down the median rainfall. *[1]*

(b) Write down the minimum rainfall. *[1]*

(c) Find the interquartile range. *[2]*

(d) Write down the number of days the rainfall will be

(i) between 43 mm and 48 mm;

(ii) between 20 mm and 59 mm. *[2]*

12. A survey investigated the relationship between the number of cleaners, n, and the amount of time, t, it takes them to clean a school.

Number of cleaners, n	Time, t (minutes)
1	193
2	172
3	118
5	112
6	87

(a) Use your graphic display calculator to write down the equation of the regression line t on n. *[2]*

(b) Write down the value of the Pearson's product–moment correlation coefficient, r. *[2]*

(c) Use your regression equation to find the amount of time 4 cleaners take to clean the school. *[2]*

19.) (a) appropriate approach (M1)
e.g. tree diagram or a table

$P(\text{win}) = P(H \cap W) + P(A \cap W))$ (M1)
$= (0.65)(0.83) + (0.35)(0.26)$ A1
$= 0.6305$ (or 0.631) A1N2

(b) evidence of using complement (M1)
e.g. $1 - p$, 0.3695

choosing a formula for conditional probability (M1)
e.g. $P(H \mid W') = \dfrac{P(W' \cap H)}{P(W')}$

correct substitution
e.g. $\dfrac{(0.65)(0.17)}{0.3695} \left(= \dfrac{0.1105}{0.3695} \right)$ A1

$P(\text{home}) = 0.299$ A1N3

[8]

16.) (a) $P(A) = \dfrac{1}{11}$ A1 N1

(b) $P(B \mid A) = \dfrac{2}{10}$ A2N2

(c) recognising that $P(A \cap B) = P(A) \times P(B \mid A)$ (M1)
correct values (A1)

e.g. $P(A \cap B) = \dfrac{1}{11} \times \dfrac{2}{10}$

$P(A \cap B) = \dfrac{2}{110}$

A1N3

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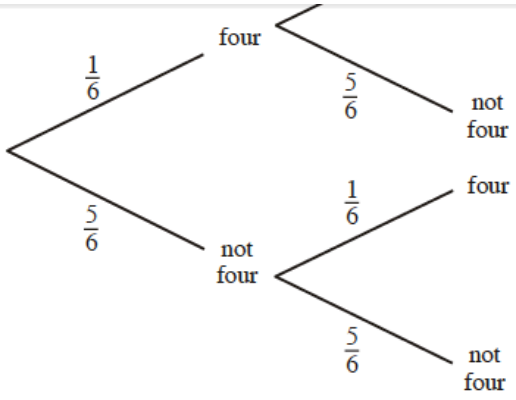
48.)



A1A1A1 N3

Note: *Award A1 for **each pair** of complementary probabilities.*

(b) $P(E) = \frac{1}{6}\times\frac{5}{6}+\frac{5}{6}\times\frac{1}{6}\ \left(=\frac{5}{36}+\frac{5}{36}\right)$ (A2)

$= \frac{10}{36}\ \left(=\frac{5}{18}\text{ or }0.278\right)$ A1 N3

(c) Evidence of recognizing the binomial distribution (M1)

eg $X \sim B\left(5, \frac{5}{18}\right)$ or $p=\frac{5}{18}, q=\frac{13}{18}$

$P(X=3) = \binom{5}{3}\left(\frac{5}{18}\right)^3\left(\frac{13}{18}\right)^2$ (or other evidence of correct setup) (A1)

$= 0.112$ A1 N3

(d) **METHOD 1**

Evidence of using the complement M1

eg $P(X \geq 3) = 1 - P(X \leq 2)$

Correct value $1 - 0.865$ (A1)

$= 0.135$ A1 N2

18.) (a) evidence of attempt to find $P(X \leq 475)$ (M1)
e.g. $P(Z \leq 1.25)$
$P(X \leq 475) = 0.894$ A1 N2

(b) evidence of using the complement (M1)
e.g. $0.73, 1-p$

$z = 0.6128$ (A1)
setting up equation (M1)
e.g. $\frac{a-450}{20} = 0.6128$
$a = 462$ A1N3

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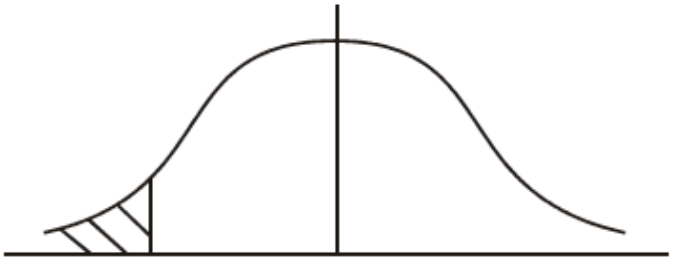
79.) (a) (i) $a = -1$ (A1)
$b = 0.5$ (A1)

(ii) (a) 0.841 (A2)

(b) $0.6915 - 0.1587$ (or $0.8413 - 0.3085$) (M1)
$= 0.533$ (3 sf) (A1) (N2) 6

(b) (i) Sketch of normal curve(A1)(A1)



(ii) $c = 0.647$ (A2) 4

[10]

37.) **METHOD 1**

(a) $\sigma = 10$ (A1)
$1.12 \times 10 = 11.2$ A1
$11.2 + 100$ (M1)
$x = 111.2$ A1N2

(b) $100 - 11.2$ (M1)
$= 88.8$ A1N2

[6]

METHOD 2

(a) $\sigma = 10$ (A1)
Evidence of using standardisation formula (M1)
$\frac{x-100}{10} = 1.12$ A1
$x = 111.2$ A1N2

(b) $\frac{100-x}{10} = 1.12$ A1
$x = 88.8$ A1N2

[6]

Box and whisker problem:

43, 10, 28, 20 days, 60 days

Cleaning problem:

t = –20.1n + 205
r = –0.941
125 mins