# MATHEMATICS METHODS : UNITS 1 & 2, 2020

## Test 3 –Trigonometric, Probability, Counting, Exponentials (10%)
## (1.2.10 to 1.2.16, 1.3.6 to 1.3.17, 2.1.1 to 2.1.7)
## Calculator Assumed - Allow 1 Minute of Reading Time

| Time Allowed | First Name | Surname | Marks |
|---|---|---|---|
| 25 Minutes | SOLUTIONS | | 23 marks |

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**Assessment Conditions:** ***(N.B. Sufficient working out must be shown to gain full marks)***

- Calculators: Allowed
- Formula Sheet: Provided
- Notes: Not Allowed

**6. (1, 3 = 4 marks)**
An under 16 soccer coach must choose a team of 11 players from 2 Goalkeepers, 8 Defenders, 6 Midfielders and 6 Strikers.

**a.** Determine how many different teams of 11 players he can make if there are no restrictions.

$^{22}C_{11} = 705432$ ✓

**b.** Determine how many different teams can be made if he has to pick 1 Goalkeeper, 4 Defenders, 3 Midfielders and 3 Strikers to form a team.

$^{2}C_{1} \times {}^{8}C_{4} \times {}^{6}C_{3} \times {}^{6}C_{3}$ ✓✓ -1 each error

$= 56000$ ✓

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7. **(2, 2, 2 = 6 marks)**
In a small suburb of Perth, it is found that the population of mosquitoes decreases as the population of spiders increases. Scientists found that this can be modelled exponentially.

**a.** The population of mosquitoes decreased at a rate of 10% per month and was originally 100,000. Determine an exponential equation in the form $P_m = k(a)^t$ to represent this information.

$$P_M = \underbrace{100{,}000}_{\checkmark} \times \underbrace{0.9}_{\checkmark}{}^t$$

**b.** Determine, after which month the mosquito population will be halved.

(f.t from part a)

$$0.5 = 0.9^t$$
$$t = 6.58 \text{ months}$$

✓ for eqn and 6.58...

$\therefore$ After $7^{th}$ month ✓

must be $7^{th}$ and writes units.

**c.** If the population of spiders increases by 20% per month and can be modelled according to the exponential equation $P_s = 10000(1.2)^t$, determine when the populations will be equal leaving your answer to one decimal place.

(f.t)

$$100000 \times 0.9^t = 10000 \times 1.2^t$$

✓ equates together

$$t = 8.0 \text{ months}$$

✓ (1dp)

6/6

**8. (2, 2, 3 = 7 marks)**

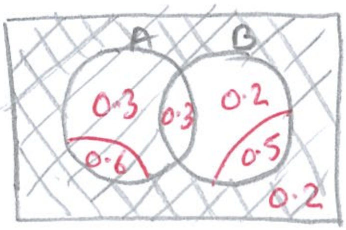
Given that for events $A$ and $B$ the $P(A) = 0.6, P(A|B) = 0.6\ and\ P(A \cap B) = 0.3$

**a.** Determine $P(B|A)$

$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{0.3}{0.6} = \frac{1}{2}$$

-1 if in a) or b) left as decimal in fraction

**b.** Determine $P(\overline{A \cup B}|\bar{B})$




$$P(\overline{A \cup B}|\bar{B}) = \frac{0.2}{0.3 + 0.2} = \frac{0.2}{0.5} = \frac{2}{5} \text{ or } 0.4$$

**c.** Determine whether $A$ and $B$ are independent, mutually exclusive or other. Justify your answer.

or

$P(B|A) = P(B)$

$0.5 = 0.5$

or

$P(A|B) = P(A)$

$0.6 = 0.6$

$P(A) \times P(B) = P(A \cap B)$

LHS $0.6 \times 0.5 = 0.3$

RHS $P(A \cap B) = 0.3$

LHS $=$ RHS

$\therefore$ A and B are independent

shows LHS = RHS using any of 3 ways

states independent

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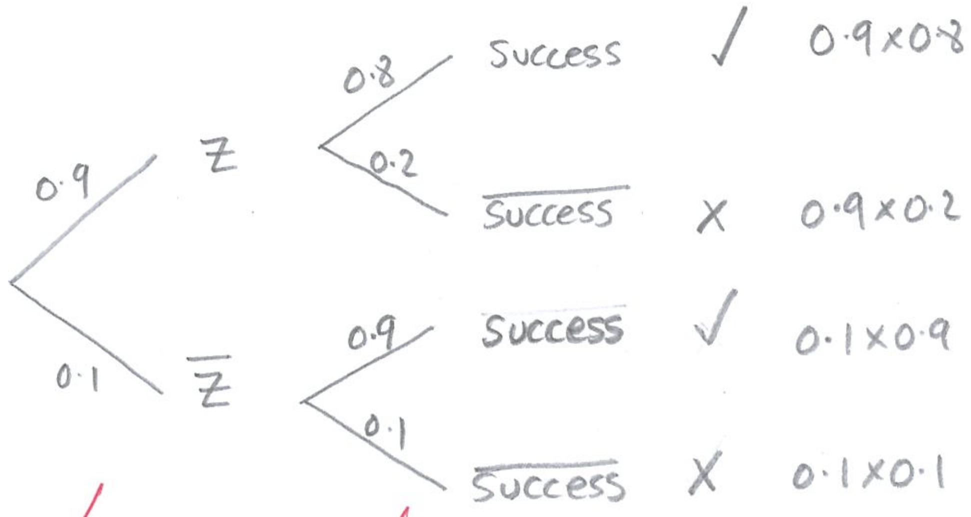
**9. (2, 2, 2 = 6 marks)**

In Zombieland you have a 90% chance of becoming a Zombie from a worldwide airborne virus called Zee. The disease takes 1 week for an individual to experience symptoms and start turning into a Zombie. A test to identify the disease has been rushed into production, but it only shows an 80% success rate in detecting those who have the disease and a 90% success rate for those who do not have the disease.

**a.** Draw a probability tree to represent this information.




✓ ✓

**b.** Determine the probability that the test will give the correct result.

$0.9 \times 0.8 + 0.1 \times 0.9$

$= 0.72 + 0.09$ ✓

$= 0.81$ ✓

**c.** Determine the probability that the test is incorrect, despite the test showing they have the disease.

$$P(\text{incorrect} \mid \text{test shows disease}) = \frac{0.1 \times 0.1}{0.9 \times 0.8 + 0.1 \times 0.1} \checkmark \checkmark$$

$$= \frac{0.01}{0.73}$$

$$= \frac{1}{73}$$

−1 if not simplified

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