

2019 Year 11 Mathematics Specialist Semester One Exam Preparation**Question 1****(9 marks)**(a) Evaluate ${}^{25}P_{19} \div {}^{23}P_{20}$ **(3 marks)**(b) Express $8! + 7! + 6!$ in the form $a^2b!$, where a and b are positive integers. **(3 marks)**(c) Show that for $n \in \mathbb{Z}, n \geq 1$, the sum $(n + 2)! + (n + 1)! + n!$ can always be expressed in the form $a^2b!$ where a and b are positive integers. **(3 marks)**

Question 2**(10 marks)**

(a) If $\mathbf{a} = 3\mathbf{i} - 5\mathbf{j}$, $\mathbf{b} = -2\mathbf{i} + 7\mathbf{j}$, Determine

(i) $2\mathbf{a} - 3\mathbf{b}$

(2 marks)

(ii) $|\mathbf{a} + \mathbf{b}|$

(2 marks)

(iii) The unit vector \mathbf{c} that is parallel and in the same direction as $\mathbf{b} - \mathbf{a}$ (3 marks)

(b) Given that \mathbf{d} and \mathbf{e} are non-parallel vectors, find the values of γ and μ in the following expression: $(\gamma + \mu - 4)\mathbf{d} = (\mu - 3\gamma)\mathbf{e}$ (3marks)

Question 3**(7 marks)**

(a) A body moves from $P(2, -3)$ to $Q(-2, 1)$.

(i) Determine the displacement vector \overrightarrow{PQ} in component form. (1 mark)

(ii) Determine the magnitude of the vector \overrightarrow{PQ} . (1 mark)

(b) A force of $6\mathbf{i} - 6\sqrt{3}\mathbf{j}$ N acts on a body. Determine the magnitude of the force and the angle its direction makes with the positive x -axis. (2 marks)

(c) A body moves with a velocity of 20 ms^{-1} at an angle of 135° with the positive x -axis. Express the velocity of the body in the form $a\mathbf{i} + b\mathbf{j}$, where a and b are constants. (3 marks)

Question 4**(8 marks)**

(a) Write the inverse of the following true statement and comment on the truth of the inverse statement. "If the discriminant of the quadratic formula is zero, then the quadratic has just one real root." (2 marks)

(b) Write the converse of the following true statement and comment on the truth of the converse statement. "If $x > 3$ then $x > 2$." (2 marks)

(c) Determine the truth of the following statements, using an example or counter-example to support each answer.

(i) If $z \in \mathbb{R}$ and z^3 is an even number then z is an even number. (2 marks)

(ii) $\forall x > 1$ and $x \in \mathbb{Z}$, $x^2 - x + 1$ is prime. (2 marks)

Question 5**(7 marks)**

- (a) Write down and prove the contrapositive of the statement “if $n^2 + 2n + 6$ is odd, then n is odd”.
- (3 marks)

- (b) Prove by contradiction that it is impossible to draw a circle through the vertices of quadrilateral shown below.
- (4marks)

