Question 1

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QUESTION 8

Let $P(n)$ be the proposition that

$$\sum_{r=1}^{n}(r+1)3^{r-1} = n\times 3^n \ \forall n \in Z^+$$

Which option represents a correct formulation of the assumption that $P(k)$ is true $\forall k \in Z^+$ in a proof using mathematical induction?

(A) $\sum_{r=1}^{k}(k+1)3^{k-1} = k\times 3^k$

(B) $\sum_{r=1}^{k}(k+1)3^{k-1} = n\times 3^n$

(C) $\sum_{r=1}^{k}(r+1)3^{r-1} = k\times 3^k$

(D) $\sum_{r=1}^{k}(r+1)3^{r-1} = r\times 3^r$

Question 2

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QUESTION 6

Given $z = 2 - 2i$ and $w = -3 + i$, calculate $z^2 - \bar{w}$

(A) $3 - 9i$

(B) $3 - 7i$

(C) $11 - 9i$

(D) $11 - 7i$

Question 3

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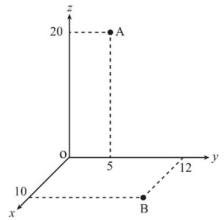
QUESTION 4

Consider points A and B as shown.



The position vector representing the midpoint of AB is

(A) $\begin{pmatrix}5\\8.5\\10\end{pmatrix}$

(B) $\begin{pmatrix}5\\10\\8.5\end{pmatrix}$

(C) $\begin{pmatrix}10\\8.5\\5\end{pmatrix}$

(D) $\begin{pmatrix}10\\5\\8.5\end{pmatrix}$

Question 4

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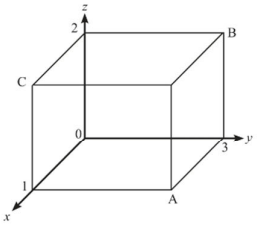
QUESTION 12 (8 marks)

Consider the vertices A, B and C of the rectangular prism as shown.



a) State the coordinates of A, B and C. *[1 mark]*

b) Determine a unit vector, $\hat{\boldsymbol{n}}$, that is normal to the plane containing A, B and C. *[3 marks]*

c) Verify that $\hat{\boldsymbol{n}}$ is perpendicular to $\overrightarrow{AB}$. *[2 marks]*

d) Determine the Cartesian equation of the plane that contains A, B and C. *[2 marks]*

Question 5

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QUESTION 16 (6 marks)

Use mathematical induction to prove that $2^{2n} + 3n - 1$ is divisible by 3 $\forall n \in Z^+$.