Question 1

QUESTION 3

Simple Familiar
Technology Free
2021

An object has a velocity $\boldsymbol{v}(t) = e^{-2t}\hat{\boldsymbol{i}} + \left(\frac{1}{t}\right)\hat{\boldsymbol{k}}$, where t represents time $(t > 0)$.

The displacement $\boldsymbol{r}(t)$ of the object could be

(A) $-2e^{-2t}\hat{\boldsymbol{i}} + \ln(t)\hat{\boldsymbol{k}}$

(B) $-2e^{-2t}\hat{\boldsymbol{i}} - \frac{1}{t^2}\hat{\boldsymbol{k}}$

(C) $-\frac{1}{2}e^{-2t}\hat{\boldsymbol{i}} + \ln(t)\hat{\boldsymbol{k}}$

(D) $-\frac{1}{2}e^{-2t}\hat{\boldsymbol{i}} - \frac{1}{t^2}\hat{\boldsymbol{k}}$

Question 2

QUESTION 6

Simple Familiar
Technology Free
2022

The Cartesian equation for a sphere with centre $(-2, 3, -4)$ and radius 9 is

(A) $(x-2)^2 + (y+3)^2 + (z-4)^2 = 9$

(B) $(x+2)^2 + (y-3)^2 + (z+4)^2 = 9$

(C) $(x-2)^2 + (y+3)^2 + (z-4)^2 = 81$

(D) $(x+2)^2 + (y-3)^2 + (z+4)^2 = 81$

Question 3

QUESTION 1

Simple Familiar
Technology Free
2022

Let $z = a + 3i$ and $w = -3 + bi$, where $a, b \in R$.

If $z = w$, then

(A) $a = -3, b = -3$

(B) $a = -3, b = 3$

(C) $a = 3, b = -3$

(D) $a = 3, b = 3$

Question 4

QUESTION 14 (6 marks)

Simple Familiar
Technology Free
2021

An object is projected vertically upwards from ground level. After the object has been in motion for t seconds, its position vector through the air, in metres, is modelled by

$$\boldsymbol{r}(t) = 5t(8-t)\hat{\boldsymbol{j}}$$

a) Determine the velocity of the object through the air, $\boldsymbol{v}(t)$, in metres per second. *[2 marks]*

b) Determine the number of seconds until the object reaches its maximum height. *[2 marks]*

c) Determine the maximum height that the object reaches, in metres. *[2 marks]*

Question 5

QUESTION 16 (6 marks)

Complex Familiar
Technology Free
2020

Given $\cos(\theta) \neq 0 \;\forall\; n \in Z^+$, use mathematical induction to prove

$$\cos(\theta) - \cos(3\theta) + \cos(5\theta) - \ldots + (-1)^{n+1}\cos\left((2n-1)\theta\right) = \frac{1-(-1)^n\cos(2n\theta)}{2\cos(\theta)}$$