USMANU DANFODIYO UNIVERSITY SOKOTO

DEPARTMENT OF MATHEMATICS

SECOND SEMESTER EXAMINATION 2014/2015 SESSION

COURSE: MAT 102 COURSE TITLE: ELEMENTARY MA...

COURSE UNIT: 3Units TIME ALLOWED: 2 hours

INSTRUCTION: Answering four questions and do not write on the question paper

1(a) Find the magnitude, direction ratio and direction cosine of the vector $\vec{a} = 3\hat{i} - 2\hat{j} + 6\hat{k}$

(b) If $\vec{A} = 3\hat{i} - \hat{j} - 4\hat{k}$, $\vec{B} = 2\hat{i} + 4\hat{j} - 3\hat{k}$ and $\vec{C} = \hat{i} + 2\hat{j} - \hat{k}$ Find

(i) $2\vec{A} - \vec{B} + 3\vec{C}$ (ii) $\left|\vec{A} + \vec{B} + \vec{C}\right|$ (iii) $\left|3\vec{A} - 2\vec{B} + 4\vec{C}\right|$

2(a) Determine the value of x so that $\vec{a} = 2\hat{i} + 3\hat{j} + x\hat{k}$ and $\vec{b} = 4\hat{i} - 2\hat{j} + 2\hat{k}$ are perpendicular.

(b) Find the projection of the vector $\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$ on the vector $\vec{b} = 6\hat{i} - 3\hat{j} + 2\hat{k}$

3(a) If $\vec{a} = \hat{i} + 4\hat{j} - 2\hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$ find

(i) $\vec{a} \times \vec{b}$ (ii) $\left(\vec{a} + \vec{b}\right) \times \left(\vec{a} - \vec{b}\right)$ (iii) $\vec{b} \times \vec{c}$

(b) Find the vector perpendicular to the plane ABC where A, B and C are the points $(4, -1, 3)$, $(4, -3, 1)$ and $(1, -1, -3)$

4(a) If A and B are differentiable function of scalar U, prove

(i) $\frac{d}{du}(A \cdot B) = A \cdot \frac{dB}{du} + \frac{dA}{du} \cdot B$ (ii) $\frac{d}{du}(A \times B) = A \times \frac{dB}{du} + \frac{dA}{du} \times B$

(b) If $\vec{A} = 5t^2\hat{i} + t\hat{j} - t^3\hat{k}$ and $\vec{B} = \sin t\,\hat{i} - \cos t\,\hat{j}$ Find

(i) $\frac{d}{dy}\left(\vec{A} \cdot \vec{B}\right)$ (ii) $\frac{d}{dy}\left(\vec{A} \times \vec{B}\right)$

5 A particle move so that its position vector is given by $r = \cos wt\,i + \sin wt\,j$ where w is a constant. Show that

(a) The velocity V of the particle is perpendicular to r.

(b) The acceleration a is directed toward the origin and has magnitude proportional to the distance from the origin.

(c) $r \times v$ = a constant vector

6(a) If $\vec{R}(u) = \left(u - u^2\right)\hat{i} + 2u^3\hat{j} - 3\hat{k}$. Find (i) $\int \vec{R}(u)\,du$ (ii) $\int_0^2 \vec{R}(u)\,du$

(b) The acceleration of a particle at any time $t \geq 0$ is given by

$a = \frac{dv}{dt} = 12\cos 2t\,i - 8\sin 2t\,j + 16tk$. If the velocity v and displacement r are zero at $t = 0$. Find v and r at any time.

MAT 102 2015/2016 Session

ADMISSION NUMBER.....DEPT/UNIT .....

USMANU DANFODIYO UNIVERSITY, SOKOTO
DEPARTMENT OF MATHEMATICS

MAT 102 C/A TEST

COURSE: MAT 102 COURSE TITLE: Elementary Mathematics II
COURSE UNIT: 3 Units TIME ALLOWED: 40 Min.
INSTRUCTIONS: Answer All Questions and shade the Correct Answer.
Do not write on this Question Paper.

1.	[a]	[b]	[c]	[d]	3.	[a]	[b]	[c]	[d]
2.	[a]	[b]	[c]	[d]	6.	[a]	[b]	[c]	[d]
5.	[a]	[b]	[c]	[d]	9.	[a]	[b]	[c]	[d]
8.	[a]	[b]	[c]	[d]					

1. A unit vector in the direction of $\vec{b} = 3\hat{i} - 2\hat{j} + 6\hat{k}$ is

(A) $\frac{1}{7}$ (B) $\frac{3}{7}\hat{i} - \frac{6}{7}\hat{j} + \frac{7}{2}\hat{k}$ (C) $\frac{3i-2j+6k}{7}$ (D) $\frac{1}{7}(3\hat{i} - 6\hat{j} + 2\hat{k})$

2. Determine the value of x so that $\vec{a} = 2\hat{i} + 3\hat{j} + x\hat{k}$ and $\vec{a} = 4\hat{i} - 2\hat{j} - 2\hat{k}$ is perpendicular

(A) 4 (B) 1 (C) 0 (D) 2

3. Find the area of the parallelogram determined by the vector $\hat{i} + 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$

(A) 196 (B) $8\sqrt{3}$ (C) $\frac{1}{2}\sqrt{192}$ (D) $4\sqrt{3}$

4. Find the volume of a parallelepiped with sides $\vec{A} = 3\hat{i} - \hat{j}$, $\vec{B} = \hat{j} + 2\hat{k}$ and $\vec{C} = \hat{i} + 5\hat{j} + \hat{k}$

(A) 6 (B) 4 (C) 20 (D) 7

5. Find area of the triangle whose vertices are A(3,-1,2), B(1,-1,-3) and C(4,-3,1) is

(A) $\frac{1}{2}\sqrt{165}$ (B) $\frac{1}{2}|-5\hat{i} - 5\hat{j} + 4\hat{k}|$ (C) $\frac{1}{2}\sqrt{-34}$ (D) $-5\hat{i} - 5\hat{j} + 4\hat{k}$

6. Given $\vec{a} = Sint\hat{i} + Cost\hat{j} + 3t\hat{k}$ Find $\left|\frac{d\vec{a}}{dt}\right|$

(A) $-sint\hat{i} + cost\hat{j} - 3$ (B) 2 (C) 4 (D) $cost\hat{i} + sint\hat{j} + 3$

7. A particle moves so that it's position vector is given by $r = cos3t\hat{i} + sin6t\hat{j} - 2e^{-3t}\hat{k}$. Find it's acceleration

(A) $6(cos6t\hat{i} + 6sin6t\hat{j} + e^{-3t}\hat{k})$ (B) $20\hat{i} - 20\hat{j} + 16\hat{k}$

(C) $-6(cos3t\hat{i} + 6sin6t\hat{j} + 2e^{-3t}\hat{k})$ (D) $6(cos6t\hat{i} + 6sin6t\hat{j} - 2e^{-3t}\hat{k})$

8. The acceleration of a particle at any time $t \geq 0$ is given by $a = 4s^{in}t2t + 4cos4t + e$ Find it's velocity at any time t.

(A) $2cost + sin4t + e^{-t} + c$ (B) $-2cost + sin4t - e^{-t} + c$ (C) $2\hat{i} - 20\hat{j} + 16\hat{k}$

(D) $-24\hat{i} - 15\hat{j} - 16\hat{k}$

9. If $\vec{A} = 5t^2\hat{i} + t\hat{j} - t^3\hat{k}$, and $\vec{B} = sint\hat{i} - cost\hat{j}$. Find the derivative of $\vec{A} \cdot \vec{B}$

(A) $(5t^2 + 1)cost + 11tsint$ (B) $(5t^2 - 1)cost + 11tsint$

(C) $(5t^2 - 1)cost + 11sint$ (D) $(5t^2 - 1)cost - 11tsint$

10. Vectors which have the same terminal point are called

(A) Zero Vectors (B) Like Vectors (C) Coterminous Vectors

(D) Unlike Vectors

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1. Find the area of the parallelogram determined by the vectors $\hat{i} - 2\hat{j} + 3\hat{k}$ and $4\hat{i} - \hat{j} + 2\hat{k}$
(A) 150 (B) $6\sqrt{5}$ (C) $\frac{1}{2}\sqrt{150}$ (D) $5\sqrt{6}$

2. The projection of the vector $5\hat{i} - 3\hat{j} + 2\hat{k}$ on the vector $-\hat{i} + 2\hat{j} - \hat{k}$ is
(A) $\frac{-13}{\sqrt{6}}$ (B) $\frac{13}{\sqrt{38}}$ (C) $\frac{13}{\sqrt{6}}$ (D) $\frac{-13}{\sqrt{38}}$

3. Find $|\vec{a} - \vec{b}|$, if $|\vec{a}| = 3, |\vec{b}| = 5$ and $\vec{a} \cdot \vec{b} = 9$.
(A) $\sqrt{13}$ (B) $\sqrt{-9}$ (C) 4 (D) $\sqrt{31}$

4. The direction cosine of the vector $\vec{a} = 3\hat{i} - 4\hat{k}$ is
(A) $2\sqrt{5}$ (B) $\frac{3}{5}, 0, \frac{-4}{5}$ (C) $\sqrt{\frac{7}{8}}$ (D) $\frac{6}{6}, \frac{-4}{6}, \frac{3}{6}$

5. Determine the value of x so that $\vec{a} = 2\hat{i} + x\hat{j} + 1\hat{k}$ and $\vec{b} = 4\hat{i} - 2\hat{j} - 2\hat{k}$ are perpendicular
(A) -1 (B) 3 (C) 0 (D) 1

6. If $\vec{a} \cdot \vec{b} = 0$, then this implies that $\vec{a}$ is
(A) Parallel to $\vec{b}$ (B) Co-initial vector (C) Perpendicular to $\vec{b}$ (D) Unit vector

7. Find the vector perpendicular to the plane where A,B and C are the points (4, 1,3), (4,-3,-1) and C(1, 1,-3) respectively
(A) $\frac{2\hat{i}+3\hat{j}-\hat{k}}{6}\sqrt{6}$ (B) $\frac{2\hat{i}-\hat{j}-\hat{k}}{3}\sqrt{3}$ (C) $\frac{1}{2}\sqrt{-4}$ (D) $\frac{2\hat{i}+\hat{j}-\hat{k}}{6}\sqrt{6}$

8. The area of parallelogram formed by the vectors with diagonals $\hat{i} - \hat{j} - 2\hat{k}$ & $-4\hat{i} + 3\hat{j} + 4\hat{k}$ is
(A) $5\sqrt{3}$ (B) $2\sqrt{38}$ (C) $3\sqrt{2}$ (D) $\sqrt{5}$

9. If $\vec{a}$ is a vector such that $\left|-\frac{3}{4}\vec{a}\right| = 1$. Find the magnitude of $\vec{a}$
(A) $-\frac{3}{4}$ (B) $-\frac{4}{3}$ (C) $\frac{4}{3}$ (D) $\frac{3}{4}$

10. Find the unit tangent vector at $t = 0$ on the curve $x = t^3 - 1, y = 4t^2 - 3$, and $z = 2t^2 + 6t$.
(A) $\frac{\hat{i}+6\hat{k}}{\sqrt{37}}$ (B) $\frac{-\hat{i}+6\hat{k}}{\sqrt{37}}$ (C) $\frac{-\hat{i}-6\hat{k}}{\sqrt{37}}$ (D) $\frac{4\hat{i}+8\hat{j}+6\hat{k}}{\sqrt{2}}$

11. Find the magnitude of the vector $\vec{a} = 3\hat{i} - 4\hat{j} + 5\hat{k}$.
(A) $5\sqrt{2}$ (B) 7 (C) $2\sqrt{5}$ (D) $\sqrt{7}$

12. Find $\vec{a} \times \vec{b}$, if $\vec{a} = 2\hat{i} - 3\hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + 4\hat{j} - 2\hat{k}$
(A) $10\hat{i} + 3\hat{j} + 11\hat{k}$ (B) $-10\hat{i} - 3\hat{j} - 11\hat{k}$ (C) $10\hat{i} + 3\hat{j} - 11\hat{k}$ (D) $10\hat{i} - 3\hat{j} - 11\hat{k}$

13. If $\vec{a}$ and $\vec{b}$ are non-zero vectors the projection of $\vec{b}$ on $\vec{a}$ is
(A) $\hat{a} \cdot \vec{b}$ (B) zero (C) $\overrightarrow{ab}$ (D) $\hat{b} \cdot \vec{a}$

14. Find the area of the triangle whose vertices are A(3,-1,2), B(1,-1,-3) and C(4,-3,1)
(A) $\frac{1}{2}\sqrt{66}$ (B) $\frac{1}{2}[-5\hat{i} - 5\hat{j} + 4\hat{k}]$ (C) $\frac{1}{2}\sqrt{-34}$ (D) $-5\hat{i} - 5\hat{j} + 4\hat{k}$

15. If $R = a\hat{i} + \cos t\,\hat{j} - 2\sin 2t\,\hat{k}$. Find $\left|\frac{dR}{dt}\right|$ at $t = 0$.
(A) 3 (B) $\sqrt{3}$ (C) $\sqrt{4}$ (D) -3

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2. [a] [b] [c] [d]
3. [a] [b] [c] [d]
4. [a] [b] [c] [d]
5. [a] [b] [c] [d]
6. [a] [b] [c] [d]
7. [a] [b] [c] [d]
8. [a] [b] [c] [d]
9. [a] [b] [c] [d]
10. [a] [b] [c] [d]

1. The unit vector in the direction of $\vec{b} = 3i - 2j + 6k$ is
(A)7 (B)$\frac{3}{7}i - \frac{6}{7}j + \frac{7}{2}k$ (C)$\frac{3i-2j+6k}{7}$ (D)$\frac{1}{7}(3i - 6j + 2k)$

2. Determine the value of x so that $\vec{a} = 2i + 3j + xk$ and $\vec{a} = 4i - 2j - 2k$ is perpendicular
(A)-1 (B)1 (C)0 (D)2

3. Find the area of the parallelogram determined by the vector $i + 2j + 3k$ and $3i - 2j + k$
(A)196 (B)$8\sqrt{3}$ (C)$\frac{1}{2}\sqrt{192}$ (D)$4\sqrt{3}$

4. Find the volume of a parallelepiped with sides $A = 3i - j$, $B = j + 2k$ and $C = i - 5j + 4k$
(A)6 (B)4 (C)26 (D)5

5. The area of the triangle whose vertices are A(3,-1,2), B(1,-1,-3) and C(4,-3,1) is
(A)$\frac{1}{2}\sqrt{165}$ (B)$\frac{1}{2}[-5i - 5j + 4k]$ (C)$\frac{1}{2}\sqrt{-34}$ (D)$-5i - 5j + 4k$

6. Given $\vec{R} = Sinti + Costj + 3t$ Find $\left|\frac{d\vec{R}}{dt}\right|$
(A)$-sinti + costj - 3$ (B)2 (C)4 (D)$costi + sintj + 3$

7. A particle moves so that it's position vector is given by $r = cos3ti + sin6tj + 2e^{-3t}k$
Find it's acceleration
(A) $6(cos6ti + 6sin6tj + e^{-3t}k)$ (B) $20ti - 20tj + 16k$
(C)$-6(cos3ti + 6sin6tj + 2e^{-3t}k)$ (D) $6(cos6ti + 6sin6tj - 2e^{-3t}k)$

8. The acceleration of a particle at any time $t \geq 0$ is given by $a = 4sin2t + 4cos4t + e$
Find it's velocity at any time t.
(A)$-2cost + sin4t + e^{-t} + c$ (B)$-2cost + sin4t - e^{-t} + c$ (C) $20ti - 20tj + 16k$
(D)$-24i - 15j - 16k$

9. If $\vec{A} = 5t^2i + tj - t^3k$, and $\vec{B} = sinti - costj$, Find the derivative of $\vec{A} \cdot \vec{B}$
(A)$(5t^2 + 1)cost + 11tsint$ (B)$(5t^2 - 1)cost + 11tsint$
(C)$(5t^2 - 1)cost + 11sint$ (D)$(5t^2 - 1)cost - 11tsint$

10. The Vectors which have the same terminal point are called
(A) Zero Vectors (B) Like Vectors (C) Coterminous Vectors
(D) Unlike Vectors

Cost i - Sint j + 3

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vector perpendicular to the plane where A,B and C are the points (3,-1,2), (1,-1,-3) and (4,-3) respectively

(B) $\frac{-2i-j+4k}{21}\sqrt{21}$ (C) $\frac{1}{2}\sqrt{4}$ (D) $\frac{2i-j+4k}{\sqrt{7}}$

direction cosine of the vector $\vec{a} = 7i + 6j - 6k$ is

(B) $\frac{3}{5}, 0, -1$ (C) $2\sqrt{7}$ (D) $\frac{7}{11}, \frac{6}{11}, \frac{-6}{11}$

area of the parallelogram determined by the vectors $3i - 2j + k$ and $i + 3j + 3k$

(B) $8\sqrt{3}$ (C) $\frac{1}{2}\sqrt{192}$ (D) $2\sqrt{}$

projection of the vector $-i + 2j - k$ on the vector $5i - 3j + 2k$ is,

(B) $\frac{13}{\sqrt{6}}$ (C) $\frac{-13}{\sqrt{38}}$ (D) $\frac{-13}{\sqrt{}}$

termine the value of x so that $\vec{a} = 4i + xj - 2k$ and $\vec{b} = 2i - 2j + 3k$ are perpendicular

(B) 0 (C) 3 (D) 1

$= |\vec{a}||\vec{b}|$, then this implies that $\vec{a}$ is

(B) Co- initial vector (C) Perpendicular to $\vec{b}$ (D) Unit vector

vector such that $|\vec{a}| = \frac{1}{2}$ and $\vec{a} = (1,$ find the magnitude of $\vec{a}$

(B) 1 (C) 2 (D) -1

magnitude of the vector $\vec{a} = 4j - 2k$

(B) 2 (C) $2\sqrt{5}$ (D) $\sqrt{}$

$\vec{a} \times \vec{b}$, if $\vec{a} = i + 4j - 2k$ and $\vec{b} = 2i - 3j - k$

(B) $-10i - 3j - 11k$ (C) $10i + 3j - 11k$ (D) $10i - 3j - 11$

non-zero vectors $\vec{a}$ and $\vec{b}$, the projection of $\vec{a}$ on $\vec{b}$ is

(B) $\vec{b} \cdot \vec{a}$ (C) $\overrightarrow{ab}$ (D) $\vec{a}$

area of the triangle whose vertices are A(3,-1,2), B(1,-1,-3) and C(4,-3,1)

(B) $\frac{1}{2}[-5i - 5j + 4k]$ (C) $\frac{1}{2}\sqrt{-3}$ (D) $-5i + 4k$

area of parallelogram formed by the vectors with diagonals $-3i - j + 2k$ & $i + 3j + 4k$

(B) $\sqrt{3}$ (C) $3\sqrt{5}$ (D) $\sqrt{5}$

article moves along a curve whose parametric equations are: $x = -e^{-t}$, $y - 2 = 3t = 0$, $z = 3t$. Find the magnitude of the velocity at $t = 0$.

(B) 81.006 (C) $\sqrt{37}$ (D) $\sqrt{3}$

unit tangent vector at $t = 0$ on the curve $x - t^2 - 1 = 0$, $-y = -4t^2 + 3$, $z = 2t(t -$

(B) $\frac{-i+6k}{\sqrt{52}}$ (C) $\frac{-4j-6k}{\sqrt{52}}$ (D) $\frac{4j-6k}{\sqrt{52}}$

find $|\vec{a} + \vec{b}|$, if $|\vec{a}| = 3$, $|\vec{b}| = 5$ and $\vec{a} \cdot \vec{b} = 9$.

(B) $\sqrt{-3}$ (C) 5 (D) $\sqrt{}$