Subject: Exam 1

Year. Month. Date. ( )

Problem 1

a) $\vec{QP} = \langle 1, -2, 0 \rangle$ $\vec{QR} = \langle 0, -2, 3 \rangle$ ✓

b) $\cos\theta = \dfrac{\vec{QP} \cdot \vec{QR}}{|\vec{QP}||\vec{QR}|} = \dfrac{4}{\sqrt{5}\sqrt{13}}$ ✓

Problem 2

(a) $\vec{QP} = \langle 1, -2, 0 \rangle$ $\vec{QR} = \langle 0, -2, 3 \rangle$

$Area = \frac{1}{2}|\vec{QP} \times \vec{QR}|$

$$\vec{QP} \times \vec{QR} = \begin{vmatrix} i & j & k \\ 1 & -2 & 0 \\ 0 & -2 & 3 \end{vmatrix} = -6i - 3j - 2k$$ ✓

$|\vec{QP} \times \vec{QR}| = \sqrt{36+9+4} = \sqrt{49} = 7$

$\rightarrow Area = 7/2$ ✓

(b) $\vec{n} \times \langle x, y, z \rangle = 0$

$-6x - 3y - 2z = 0 - 11$ ✓

c) $\vec{a} = \langle 1, 0, -3 \rangle$

$\vec{a} \times \vec{n} = 0 \longrightarrow$ Parallel ✓

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Problem 3

(a) $t = \pi$

$$\vec{r}(t) = 10t + \cos t\,\hat{i} + \sin t\,\hat{j}$$

$$\vec{r}(\pi) = 10\pi + (-1)\hat{i} + 0\,\hat{j} = 10\pi\,\hat{i}$$

(b) $\vec{v} = 10 - \sin t\,\hat{i} + \cos t\,\hat{j}$ ✓

$$|\vec{v}| = \sqrt{10^2 + \sin^2 t - 20\sin t + \cos^2 t}$$

$$= \sqrt{101 - 20\sin t}$$

max: $t = 0, \pi$ ✓

min: $t = \frac{\pi}{2}$ ✓

Problem 4

(a) $\begin{vmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 2 & -1 & -1 \end{vmatrix} =$

$$+1 \times \begin{vmatrix} 2 & 1 \\ -1 & -1 \end{vmatrix} + (-1) \times 2 \times \begin{vmatrix} 3 & 1 \\ 2 & -1 \end{vmatrix} + 3 \times \begin{vmatrix} 3 & 2 \\ 2 & -1 \end{vmatrix}$$

$$= 1 \times (-1) + (-2) \times (-5) + 3 \times (-7) =$$

$$-1 + (+10) + (-21) = 12$$ ✓

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(b) $a = 5, b = -7$ ✓

(c) $Mr^T = \begin{bmatrix} t \\ 3 \end{bmatrix} \rightarrow M^{-1}\begin{bmatrix} \dot{t} \\ 3 \end{bmatrix} = r^T$

$$M^{-1}\begin{bmatrix} \dot{t} \\ 3 \end{bmatrix} = \frac{1}{12}\begin{bmatrix} 1 & 1 & 4 \\ 5 & 7 & -8 \\ -7 & -5 & 4 \end{bmatrix}\begin{bmatrix} \dot{t} \\ 3 \end{bmatrix} \frac{1}{12}= \begin{bmatrix} t+12 \\ 7t-24 \\ -5t+12 \end{bmatrix}$$ ✓

(d) $\frac{d\vec{r}}{dt} = \frac{1}{12}\dot{t}\,i + 7\dot{t}\,j + -5\dot{t}\,k$ ✓

Problem 5

(a) $\vec{r} \cdot \langle 4, -3, -2 \rangle = 6$ ✓

(b) $0 = (n \cdot r)' = \underbrace{n' \cdot r}_{0} + n \cdot r' = 0 \Rightarrow n \cdot r' = 0$ ✓

99 100%

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