> • Print Name and ID number on your blue book.
>
> • BOOKS and CALCULATORS are NOT allowed. One side of one page of NOTES is allowed.
>
> • **You must show your work to receive credit.**

1. (12 pts.) The vector $\vec{a}$ has length 3 and the vector $\vec{b}$ has length 2. The angle between the vectors is $\pi/6$ ($= 30°$).

    (a) Compute the dot product $\vec{a} \cdot \vec{b}$.

    (b) Compute the length of the cross product $\vec{a} \times \vec{b}$.

2. (8 pts.) Find the distance from the point $P(2, 8, 5)$ to the plane $x - 2y - 2z = 1$.

3. (12 pts.) The points $P(0, 1, 1)$, $Q(0, 1, 2)$ and $R(1, 2, 1)$ determine a plane.

    (a) Find a vector perpendicular to the plane.

    (b) Find an equation for the plane.

4. (12 pts.) A curve is given by $\vec{r}(t) = \langle t^2 + 1,\ t^3 - 1,\ \sin(\pi t) \rangle$ for $0 \le t \le 2$.

    (a) Write down an integral whose value is the arc length of this curve. You are NOT expected to evaluate the integral.

    (b) Find a parametric equation for the line tangent to the curve at $t = 1$.

5. (6 pts.) There are two vector functions $\vec{v}(t)$ and $\vec{w}(t)$ about which the following facts are known.
$$|\vec{v}(1)| = 2, \quad |\vec{w}(1)| = 3, \quad |\vec{v}\,'(1)| = 1, \quad |\vec{w}\,'(1)| = 4,$$

    the vectors $\vec{v}(1)$ and $\vec{w}(1)$ are perpendicular, and the vectors $\vec{v}(1)$, $\vec{v}\,'(1)$ and $\vec{w}\,'(1)$ are all parallel. Compute the magnitude of $(\vec{v}(t) \times \vec{w}(t))'$ at $t = 1$.

END OF EXAM