

Math 241, Fall 2006, Merit Practice Exam 1

1. What are the symmetric equations of the line perpendicular to the plane $2x + 4z = 6$ that goes through the point $(6, 2, 1)$?
2. A projectile is fired with an initial speed of $10\sqrt{2}$ m/s at an angle of $\pi/4$ radians from the horizontal. How much time will pass before it hits the ground? How far will it have travelled before hitting the ground?
3. Consider the lines:

$$\begin{aligned}L_1: \quad x &= t + 1, \quad y = 3t - 1, \quad z = 15t - 12 \\L_2: \quad x &= 2 - s, \quad y = 1 - 2s, \quad z = -1 - 11t\end{aligned}$$

Find the unique plane P containing both of these lines.
What is the angle between the plane P and the xy -plane?

4. Find the work done by a force of 20 N acting in the direction of $\vec{v} = \langle 1, 1, 1 \rangle$ in moving an object 4 meters along the positive y -axis.
5. Consider a moving particle with position vector

$$\vec{r}(T) = \langle t, 2t - 1, 3t^2 + 5 \rangle$$

at time t .

Find the tangential and normal components of the acceleration at time t .

6. Find the arc-length parametrization of the line

$$x(t) = 2 + 4t, \quad y(t) = 1 - 12t, \quad z(t) = 3 + 3t$$

in terms of the arc-length s measured from the initial point $(2, 1, 3)$

7. Consider the plane curve $y = x^3$. Find the osculating circle to this curve at the point $(1, 1)$.