INSTRUCTIONS: Do your work on the ANSWER SHEETS which I am providing. You need not re-write the problem. Just do the work and box your answer. Circle any significant sub-results along the way. Do no more than two (2) problems per page. Label each problem. Draw a horizontal line between problems. Don’t crowd your work. Write on one side (the front side) only. Keep the top and left margins that I have drawn. Do not write ANYTHING except the page number & total pages in the “circle” provided. When you are finished, put your pages in order with this test paper on top, come up to my desk and sign-out. I'll do the stapling.

If you don’t get an acceptable answer but do show your work, I’ll give as much partial credit as I can, determined by your work. Full credit will be given only for an acceptable answer AND acceptable work. Extra Credit may be given.

Today you have 5 problems and 1 bonus. Each problem counts 10 points. Today’s problems are taken from Sects 12.4, 12.5, and 13.1.

Be sure that you turn in your NOTEBOOK before you start this test.

#6. Find the area of the triangle with vertices \( P(1, 1, 1), \ Q(2, 1, 3), \ R(3, -1, 1) \). The linear units are centimeters.

#7. Write the equations in parametric form for the line through the point \( P(2, 4, 5) \) perpendicular to the plane \( \Pi: x + 2y + 2z = 13 \).

#8. Find the distance \( d(P_0, \Pi) \) from the point \( P_0(5, 3, 8) \) to the plane \( \Pi: x + y + z = -5 \). The linear units are meters. Give an exact answer with simplified radicals (no decimals).

#9. Find the parametric equations for the tangent line to the given curve:

\[
\vec{r}(t) = (\cos t) \hat{i} + (\sin t) \hat{j} + (\sin 2t) \hat{k} \quad \text{when} \quad t_0 = \frac{\pi}{2}.
\]

#10. Evaluate \( \int_{t=1}^{t=4} \left[ \frac{1}{t} \hat{i} + \frac{1}{5-t} \hat{j} + \frac{1}{2t} \hat{k} \right] \, dt \). Give an exact answer, and simplify.

#11. (BONUS) Find an equation in \( x \) and \( y \) (with \( y \) as a function of \( x \)) whose graph is the path of

\[
\vec{r}(t) = e^t \hat{i} + \frac{2}{9} e^{2t} \hat{j}. \quad \text{[NOTE: This graph is in 2-Space.]}\]