11 questions, 10 points each. SHOW ALL YOUR WORK!

Question 1

Calculate the cross product of $r_1 = \langle 2, -1, 1 \rangle$ and $r_2 = \langle 1, 2, -1 \rangle$.

Answer: .........................

Question 2

Let $r(t) = \langle 6\sqrt{t}, t^2, e^{t^3-1} \rangle$. Find the unit tangent vector at $t = 1$, i.e. $T(1)$.

Answer: .........................
Question 3

Let \( r(t) = \langle t - 1, t^3, t^2 \rangle \). Find symmetric equation of the tangent line at point \( t = 1 \).

Answer: ..................

Question 4

Find parametric equations of the line which passes through the point \((1, 0, 1)\) and is orthogonal to the plane \(2x + y - z + 2 = 0\).

Answer: ..................
Question 5

Find the area of the parallelogram generated by the vectors \( \langle 1, -1, 1 \rangle \) and \( \langle -2, 1, 2 \rangle \).

Answer: ..................

Question 6

Find equation of the plane containing the points \( P(0, 1, 1) \), \( Q(1, 1, -2) \) and \( R(-1, 0, 1) \).

Answer: ..................
Question 7

a) Find equation of the plane which passes through the point \((1, -1, 1)\) and is parallel to the plane \(x + 2y - z - 1 = 0\).

Answer: ....................

b) What is the distance between those two planes?

Answer: ....................
Question 8

Find parametric equation of the line which passes through the point (1, 1, −1) and is orthogonal to the vectors \(\mathbf{i} + \mathbf{j}\) and \(\mathbf{j} − \mathbf{k}\).

Answer: ..................
Question 9

Find (the coordinates of) the point of intersection of the plane $2x + y - z = 2$ and the line given by the parametric equations

$$
\ell := \begin{cases}
  x = 2 + t \\
  y = 1 - t \\
  z = -1 + t
\end{cases}
$$

Answer: ..................

Question 10

Find the length of the curve given by $\mathbf{r}(t) = (t, 2\sin t, -2\cos t)$ when $1 \leq t \leq 5$.

Answer: ..................
Question 11

Find the distance between two lines:

\[
\frac{x - 1}{2} = \frac{y}{1} = \frac{z + 1}{1}, \quad \frac{x}{1} = \frac{y}{-1} = \frac{z - 1}{1}.
\]

Answer: ..................