1. Find an equation of the line segment joining the points \((-2, 2, 4)\) and \((1, 3, 5)\).

**Solution:** The vector joining our first point to the second is \((3, 1, 1)\). Thus an equation for our line is 

\[
r(t) = (-2, 2, 4) + (3t, t, t).
\]

2. Determine if the following lines in \(\mathbb{R}^3\) are parallel, intersecting or skew.

\[
r(t) = \langle 1 + 7t, 5 - 7t, 4 - 3t \rangle
\]

\[
R(s) = \langle 7 + 3s, 7 + s, 12 + 4s \rangle
\]

**Solution:** By inspection, we can eliminate the possibility that the lines are parallel, as the vectors determining the trajectory of each line are not scalar multiples. The direction of the 1st is \(\langle 7, -7, -3 \rangle\) and the 2nd is \(\langle 3, 1, 4 \rangle\). Next we will check for intersection. If they intersect they will intersect in each coordinate. Thus if they intersect

\[
1 + 7t = 7 + 3s,
\]

\[
7 + s = 5 - 7t,
\]

and \(12 + 4s = 4 - 3t\).

We can solve the first equation for \(s\) to find:

\[
s = -2 + \frac{7}{3}t.
\]

Then by plugging this into the second equation, we find that that

\[
5 + \frac{7}{3}t = 5 - 7t \quad \text{or} \quad t = 0.
\]

When \(t = 0\), we have that \(s = -2 + \frac{7}{3} \cdot 0 = -2\).

\[
r(0) = (1, 5, 4),
\]

and

\[
R(-2) = (7+3(-2), 7-2, 12+4(-2)) = (1, 5, 4).
\]

Thus at \(t = 0\) and \(s = -2\) the two lines intersect at the point \((1, 5, 4)\).

3. Determine the domain of the vectored valued function

\[
r(t) = \langle \sqrt{t}, \sqrt{49-t^2}, \frac{1}{t^2-1} \rangle.
\]

**Solution:** The domain of a vector valued function is the intersection of the domains of each component. The domain of the first component is \(t \geq 0\). The domain of the second component is \(49 - t^2 \geq 0\) or \(-7 \leq t \leq 7\). The domain of the third function is \(t \neq 1, -1\). Thus the domain of the vector valued function given is

\[
t \in [0, 1) \cap (1, 7]
\]

4. Evaluate the following limit

\[
\lim_{t \to \infty} \left( 3 \arctan(t)i - 3e^{-t}j + \frac{2t^3}{t^3+1}k \right).
\]

**Solution:** To evaluate the limit we need to evaluate the limit of each individual component.

\[
\lim_{t \to \infty} 3 \arctan(t) = 3 \cdot \frac{\pi}{2}
\]

\[
\lim_{t \to \infty} 3e^{-t} = 0
\]

\[
\lim_{t \to \infty} \frac{2t^3}{t^3+1} = \lim_{t \to \infty} \frac{2}{1 + \frac{1}{t^3}} = 2.
\]

Thus

\[
\lim_{t \to \infty} \left( 3 \arctan(t)i - 3e^{-t}j + \frac{2t^3}{t^3+1}k \right) = \left( \frac{3\pi}{2}i + 2k \right).
\]