MATH 251 – QUIZ 3 – SOLUTIONS

Point: $(2, 11, 22)$

Direction Vector:

$$\mathbf{r}'(t) = \left\langle 3, 2t, 3t^2 \right\rangle$$

Find t:

$$\left\langle 3t - 7, t^2 + 2, t^3 - 5 \right\rangle = \langle 2, 11, 22 \rangle$$

The first equation gives

$$3t - 7 = 2 \Rightarrow 3t = 9 \Rightarrow t = 3$$

And you can check that:

$$t^2 + 2 = 3^2 + 2 = 11\checkmark$$
$$t^3 - 5 = 3^3 - 5 = 27 - 5 = 22\checkmark$$

Hence $t = 3$ and

$$\mathbf{r}'(3) = \left\langle 3, 2(3), 3(3)^2 \right\rangle = \langle 3, 6, 27 \rangle$$

Answer:

$$\langle 2 + 3t, 11 + 6t, 22 + 27t \rangle$$

Date: Friday, September 17, 2021.

Question 2:

$$
\begin{aligned}
\text{Length } &= \int_0^3 \sqrt{(x'(t))^2 + (y'(t))^2 + (z'(t))^2}\, dt \\
&= \int_0^3 \sqrt{2^2 + (2t)^2 + \left(\frac{1}{3}3t^2\right)^2}\, dt \\
&= \int_0^3 \sqrt{4 + 4t^2 + t^4}\, dt \\
&= \int_0^3 \sqrt{(2 + t^2)^2}\, dt \\
&= \int_0^3 2 + t^2\, dt \\
&= \left[2t + \frac{1}{3}t^3\right]_0^3 \\
&= 2(3) + \frac{1}{3}3^3 - 0 - 0 \\
&= 6 + 9 \\
&= 15
\end{aligned}
$$