# Marked example 3

Paper 2 style · Graphic display calculator

## 3 6 marks AHL 3.14 · 3.15 ●●○ Typical

A drone flies in a straight line. At time $t$ hours its position vector, in kilometres, is $\mathbf{r} = \begin{pmatrix} -4 \\ 2 \\ 1 \end{pmatrix} + t\begin{pmatrix} 2 \\ 1 \\ 0.5 \end{pmatrix}$. A tower has its top at $T(5, 8, 1)$.

**(a)** Find the speed of the drone. **[2]**

**(b)** Find the value of $t$ when the drone is closest to $T$. **[2]**

**(c)** Find the shortest distance between the drone and $T$. **[2]**

**MARKSCHEME (a)**

$\sqrt{2^2 + 1^2 + 0.5^2}$ **M1**

$2.29 \text{ km h}^{-1}$ $(2.29128\ldots)$ **A1**

**Total 2 marks**

**MARKSCHEME (b)**

$\overrightarrow{TP} = \begin{pmatrix} 2t - 9 \\ t - 6 \\ 0.5t \end{pmatrix}$, $\overrightarrow{TP} \cdot \begin{pmatrix} 2 \\ 1 \\ 0.5 \end{pmatrix} = 5.25t - 24 = 0$ **M1**

$t = 4.57$ $\left(\frac{32}{7}\right)$ **A1**

**Total 2 marks**

**Note** Or minimise the distance on the GDC.

**MARKSCHEME (c)**

$\left|\overrightarrow{TP}\right|$ at $t = \frac{32}{7}$ **M1**

2.70 km $(2.69920\ldots)$ **A1**

**Total 2 marks**



Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software.
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