| Question Number | Scheme | Marks | Notes |
|---|---|---|---|
| **4(i)** | Equation of motion for the system | M1 | All terms required. Dimensionally correct.<br>Condone sign errors and sin/cos confusion |
| | $3050-300-2500g\sin\theta=2500a$ | A1<br>A1 | Unsimplified equation with at most one error.<br>Correct unsimplified equation<br>NB A sign error on the 300 or a sign error on $2500g\sin\theta$ counts as 2 errors (to be consistent with the penalty if they did this in 2 separate equations). |
| | $a=0.4$ (m s$^{-2}$) | A1 | Not $\frac{2}{5}$ (follows 9.8) |
| | | (4) | |
| | | | |
| **(ii)** | Equation of motion for the truck | M1 | All terms required. Dimensionally correct.<br>Condone sign errors and sin/cos confusion |
| | $T-100-500g\sin\alpha=500a$<br>$T=650$ (N) | A1<br>A1 | Unsimplified equation with at most one error. Condone negative $T$<br>Consistent sign for $T$. Correct unsimplified equation (in $a$ or their $a$) |
| | $T=650$ (N) | A1 | Must be positive |
| | | (4) | |
| **(ii) alt** | Equation of motion for the engine | M1 | All terms required. Dimensionally correct.<br>Condone sign errors and sin/cos confusion |
| | $3050-200-2000g\sin\alpha-T=2000a$<br>$T=650$ (N) | A1<br>A1 | Unsimplified equation with at most one error. Condone negative $T$<br>Correct unsimplified equation |
| | $T=650$ (N) | A1 | Must be positive |
| | | (4) | |
| | | | (i) and (ii) can be solved together by forming the two separate equations of motion and solving using simultaneous equations. M1A1A1 **for each equation** and A1A1 as above. |
| | | | If the 100 N and the 200 N are associated with the wrong vehicles, treat this as a MR. This error gives them $T = 750$ |
| | | **(8)** | |