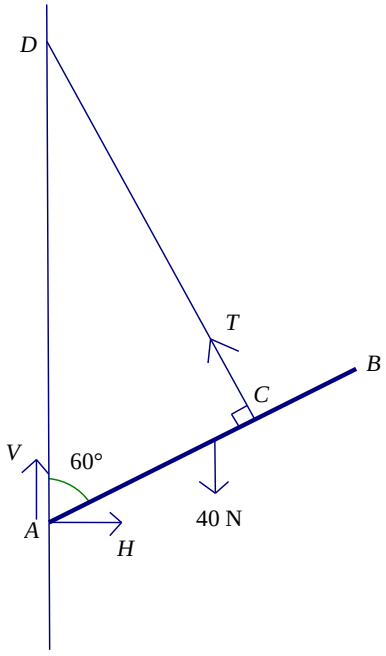
| Question | Scheme | Marks | AOs |
|---|---|---|---|
| **2 (a)** |  | | |
| | Take moments about $A$: | M1 | 3.3 |
| | $T \times 2 = 40 \times 1.5 \cos 30°$ | A1 | 1.1b |
| | $T = 15\sqrt{3}\,(\text{N}) \quad 26.0\,(\text{N})$ | A1 | 1.1b |
| | | **(3)** | |
| **(b)** | Resolve horizontally | M1 | 3.4 |
| | $H = T\cos 60° \left( = \frac{15\sqrt{3}}{2} = 12.99.... \right)$ | A1 | 1.1b |
| | Resolve vertically | M1 | 3.4 |
| | $V + T\cos 30° = 40 \quad (V = 17.5)$ | A1 | 1.1b |
| | Combine components : $\sqrt{17.5^2 + 225 \times \frac{3}{4}}$ | M1 | 3.1b |
| | $= \sqrt{475} = 5\sqrt{19} = 22(\text{N})$ | A1 | 2.2a |
| | | **(6)** | |
| **(b) alt** | Resolve parallel to the beam | M1 | 3.4 |
| | $X = 40\cos 60° \quad (= 20)$ | A1 | 1.1b |
| | Resolve perpendicular to the beam | M1 | 3.4 |
| | $Y + T = 40\cos 30° \quad \left( Y = 20\sqrt{3} - 15\sqrt{3} = 5\sqrt{3} \right)$ | A1 | 1.1b |
| | Combine components : $\sqrt{20^2 + 25 \times 3}$ | M1 | 3.1b |

| | | | |
|---|---|---|---|
| | $= \sqrt{475} = 5\sqrt{19} = 22(\text{N})$ | A1 | 2.2a |
| | | **(6)** | |
| **(c)** | The tension will not be constant | B1 | 3.5a |
| | The tension will increase as you go up the rope since it is supporting more rope | B1 | 2.4 |
| | | **(2)** | |
| | | | |
| | | | **(11 marks)** |

**Notes:**

| | |
|---|---|
| **(a)** | |
| **M1** | Or alternative complete method to form an equation in $T$ |
| **A1** | Correct unsimplified equation in $T$ |
| **A1** | 26 or better |
| **(b)** | |
| **M1** | First equation. Required terms and no extras. Condone sign errors and sin/cos confusion. |
| **A1** | Correct unsimplified equation |
| **M1** | Second equation. Required terms and no extras. Condone sign errors and sin/cos confusion. |
| **A1** | Correct unsimplified equation |
| **M1** | Correct strategy to find the resultant force |
| **A1** | 22 or better (21.79….) |
| | **N.B. There are many approaches to this. Alternative equations include e.g. moments about *C* and moments about *D*** |
| **(c)** | |
| **B1** | Correct answer |
| **B1** | Correct reasoning |