1. The line of action of the 3000-lb force runs through the points A and B as shown in the figure. Determine the x and y scalar components of F.

\[
\begin{align*}
\text{Scalar components:} & \quad \begin{cases} 
F_x = 2650 \text{ lb} \\
F_y = 1412 \text{ lb}
\end{cases}
\end{align*}
\]

\[
F = F \hat{\mathbf{n}}_{AB} = 3000 \left[ \frac{15\hat{i} + 8\hat{j}}{\sqrt{15^2 + 8^2}} \right]
\]

\[
= 2650\hat{i} + 1412\hat{j} \text{ lb}
\]
2. Determine and locate the resultant $R$ of the two force and one couple acting on the I-beam.

\[
\begin{align*}
\frac{2}{76} & \quad \frac{8 \text{ kN}}{y} & \quad R = \Sigma F_y = 5 - 8 = -3 \text{ kN} \\
25 \text{ kN} \cdot m & \quad R_1 & \quad \alpha = M_A : 3\alpha = -5(2) \\
5 \text{ kN} & \quad x = -25 + 8(4) & \quad \alpha = 4.33 \text{ m}
\end{align*}
\]
3. A carpenter a 12-Ib 2-in. by 4-in board as shown. What downward force does he feel on his shoulder at A?

\[ \sum M_B = 0 : \quad 12(3) - N_A(2) = 0 \]

\[ N_A = 18 \text{ lb} \]
4. The vertical mast supports the 4-kN force and is constrained by the two fixed cables BC and BD and by a ball- and-socket connection at A. Calculate the tension $T_1$ in BD. Can this be accomplished by using only one equation of equilibrium?
5. Calculate the y-coordinate of the centroid of the shaded area.

\[
\overline{y} = \frac{\sum A \overline{y}}{\sum A} = \frac{99.7 \text{ mm}}{1} = 99.7 \text{ mm}
\]

<table>
<thead>
<tr>
<th>Comp.</th>
<th>( A (\text{mm}^2) )</th>
<th>( \overline{x} (\text{mm}) )</th>
<th>( A \overline{y} (\text{mm}^3) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150(138.6)</td>
<td>( \frac{138.6}{2} )</td>
<td>1 440 000</td>
</tr>
<tr>
<td>2</td>
<td>( 2 \frac{1}{2} (80)(138.6) )</td>
<td>( \frac{1}{3} (138.6) )</td>
<td>512 000</td>
</tr>
<tr>
<td>3</td>
<td>( \pi \frac{75^2}{2} )</td>
<td>( \frac{4(75)}{3\pi} )</td>
<td>-281 250</td>
</tr>
<tr>
<td>4</td>
<td>( \pi \frac{75^2}{2} )</td>
<td>( 138.6 + \frac{4(75)}{3\pi} )</td>
<td>1 505 565</td>
</tr>
</tbody>
</table>

\( \Sigma A = 31870 \)

\( \Sigma A \overline{y} = 3.18 \times 10^6 \)
6. The speed of a particle traveling along a straight line path within a liquid is measured as a function of its position as \( v = (100 - s) \) mm/s, where \( s \) is in millimeter. Determine (a) the particle's deceleration when it is located at point A, where \( S_A = 50 \) mm; (b) the distance of the particle travels before it stops; (c) the time needed to stop the particle. When \( t = 0 \) and \( S = 0 \).

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**Given:** The speed of particle \( v = (100 - s) \) m/s where \( s \) is in mm.

**Find:** Acceleration \( a \) when \( s_A = 50 \) mm

**Solution:**

\[
a = \frac{dv}{dt} = \frac{d}{dt}(100 - s) = -\frac{ds}{dt} = -v = -(100 - s) \text{ mm/s}^2
\]

When \( s = s_A = 50 \) mm,

\[
a = a_A = -50 \text{ mm/s}^2
\]

**Find:** Distance traveled \( s \) when \( v = 0 \) m/s

**Solution:**

From \( v = 100 - s \) when \( v = 0 \) m/s,

\[
s = 100 \text{ mm}
\]

This is the distance traveled as the particle does not traverse any portion of its path twice.

**Find:** The time needed to traverse the distance above nothing that when \( t = 0 \), \( s = 0 \) mm

**Solution:**

Using \( v = \frac{ds}{dt} = 100 - s \), rewriting and integrating yields

\[
t = \int_0^s dt = \int_0^{100 - s} \frac{ds}{100 - s} = \ln(100 - s)
\]

As \( s \) approaches 100 mm \( t \) approaches infinity

\[
t = \infty
\]