Bounds — Substitute into Formula

Core Worksheet

Worked Examples & Guided Practice

I Do (Teacher Model) $v = \frac{s}{t}$. $s = 4.2$ correct to 1 decimal place. $t = 1.3$ correct to 1 decimal place. Calculate the upper bound for v.

We Do (Guided Practice) $D = \frac{M}{V}$. $M = 45$ correct to the nearest whole number. $V = 3.2$ correct to 1 decimal place. Calculate the lower bound for D. Give your answer to 2 decimal places.

You Do (Independent Practice) $P = I^2R$. $I = 5.4$ correct to 1 decimal place. $R = 2.0$ correct to 1 decimal place. Calculate the upper bound for P.

Challenge (Extension) $y = \frac{2x^2}{z}$. $x = 3.4$ correct to 1 decimal place. $z = 1.2$ correct to 1 decimal place. Calculate the upper bound for y.

Practice Perfect Questions

Q1. $c = a + b$. $a = 12$ to the nearest whole number, $b = 15$ to the nearest whole number. Find the upper bound of c.

Q2. $x = y - z$. $y = 20.5$ to 1 decimal place, $z = 4.2$ to 1 decimal place. Find the lower bound of x.

Q3. $F = ma$. $m = 12.5$ to 1 decimal place, $a = 9.8$ to 1 decimal place. Find the upper bound of F.

Q4. $s = \frac{d}{t}$. $d = 100$ to the nearest 10, $t = 9.5$ to 1 decimal place. Find the lower bound of s. Give your answer to 2 decimal places.

Q5. $E = \frac{1}{2}mv^2$. $m = 4.0$ to 1 decimal place, $v = 15$ to the nearest whole number. Find the upper bound of E.

Q6. $p = \frac{x - y}{z}$. $x = 10.0$ to 1 decimal place, $y = 4.5$ to 1 decimal place, $z = 2.0$ to 1 decimal place. Find the upper bound of p.

Answers & Worked Solutions

Model Solutions

- **I Do:** Bounds: $s \in [4.15, 4.25)$, $t \in [1.25, 1.35)$. Upper bound $v = \dfrac{s_{\text{UB}}}{t_{\text{LB}}} = \dfrac{4.25}{1.25} = 3.4$
- **We Do:** Bounds: $M \in [44.5, 45.5)$, $V \in [3.15, 3.25)$. Lower bound $D = \dfrac{M_{\text{LB}}}{V_{\text{UB}}} = \dfrac{44.5}{3.25} = 13.6923\cdots = 13.69$ (to 2 d.p.)
- **You Do:** Bounds: $I \in [5.35, 5.45)$, $R \in [1.95, 2.05)$. Upper bound $P = (I_{\text{UB}})^2 \times R_{\text{UB}} = 5.45^2 \times 2.05 = 29.7025 \times 2.05 = 60.890125$
- **Challenge:** Bounds: $x \in [3.35, 3.45)$, $z \in [1.15, 1.25)$. Upper bound $y = \dfrac{2(x_{\text{UB}})^2}{z_{\text{LB}}} = \dfrac{2(3.45)^2}{1.15} = \dfrac{2(11.9025)}{1.15} = \dfrac{23.805}{1.15} = 20.7$

Practice Perfect Questions Solutions

Q1. UB for addition $= a_{\text{UB}} + b_{\text{UB}}$. $12.5 + 15.5 = 28$

Q2. LB for subtraction $= y_{\text{LB}} - z_{\text{UB}}$. $20.45 - 4.25 = 16.2$

Q3. UB for multiplication $= m_{\text{UB}} \times a_{\text{UB}}$. $12.55 \times 9.85 = 123.6175$

Q4. LB for division $= \dfrac{d_{\text{LB}}}{t_{\text{UB}}} = \dfrac{95}{9.55} = 9.9476\cdots = 9.95$ (to 2 d.p.)

Q5. UB $= \dfrac{1}{2} \times m_{\text{UB}} \times (v_{\text{UB}})^2 = 0.5 \times 4.05 \times 15.5^2 = 0.5 \times 4.05 \times 240.25 = 486.50625$

Q6. UB $= \dfrac{x_{\text{UB}} - y_{\text{LB}}}{z_{\text{LB}}} = \dfrac{10.05 - 4.45}{1.95} = \dfrac{5.6}{1.95} = \dfrac{112}{39} \approx 2.87$