Index Rules with Unknowns in the Indices

Core Worksheet

Worked Examples & Guided Practice

I Do (Teacher Model) Solve $2^{3x+1} = 32$.

We Do (Guided Practice) Solve $9^{x-1} = 27^{2x+1}$.

You Do (Independent Practice) Solve $5^{2x} \times 25^{x+1} = 125^{x-2}$.

Challenge (Extension) Solve $2^{2x} - 6(2^x) + 8 = 0$.

Practice Perfect Questions

Q1. Solve $3^{2x-1} = 81$.

Q2. Solve $4^{x+2} = 64$.

Q3. Solve $8^{x+1} = 16^{x-2}$.

Q4. Solve $5^{3x} \div 25^{x} = 125$.

Q5. Solve $9^{x+1} = \dfrac{1}{27}$.

Q6. Solve $3^{2x} - 12(3^x) + 27 = 0$.

Answers & Worked Solutions

Model Solutions

- **I Do:** $2^{3x+1} = 2^5 \implies 3x+1 = 5 \implies 3x = 4 \implies x = \dfrac{4}{3}$
- **We Do:** $(3^2)^{x-1} = (3^3)^{2x+1} \implies 3^{2x-2} = 3^{6x+3} \implies 2x-2 = 6x+3 \implies 4x = -5 \implies x = -\dfrac{5}{4}$
- **You Do:** $5^{2x} \times 5^{2(x+1)} = 5^{3(x-2)} \implies 5^{4x+2} = 5^{3x-6} \implies 4x+2 = 3x-6 \implies x = -8$
- **Challenge:** Let $y = 2^x \implies y^2 - 6y + 8 = 0 \implies (y-2)(y-4) = 0 \implies y = 2$ or $y = 4 \implies 2^x = 2 \implies x = 1$; $2^x = 4 \implies x = 2$

Practice Perfect Questions Solutions

Q1. $3^{2x-1} = 3^4 \implies 2x-1 = 4 \implies x = 2.5$

Q2. $4^{x+2} = 4^3 \implies x+2 = 3 \implies x = 1$

Q3. $2^{3(x+1)} = 2^{4(x-2)} \implies 3x+3 = 4x-8 \implies x = 11$

Q4. $5^{3x} \div 5^{2x} = 5^3 \implies 5^x = 5^3 \implies x = 3$

Q5. $3^{2(x+1)} = 3^{-3} \implies 2x+2 = -3 \implies 2x = -5 \implies x = -2.5$

Q6. Let $y = 3^x \implies y^2 - 12y + 27 = 0 \implies (y-3)(y-9) = 0 \implies y = 3 \implies x = 1$; $y = 9 \implies x = 2$