

90 mins

ACHA 3000

2nd November

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1) Simplify;

$$(i) x^4 \cdot x^6 \cdot x \Rightarrow x^4 \cdot x^6 \cdot x^1 \Rightarrow x^{4+6+1} \Rightarrow x^{11}$$

$$(ii) 2x^2 \cdot 3x^3 \cdot 2x \Rightarrow 12x^2 \cdot x^3 \cdot x^1 \Rightarrow 12x^{2+3+1} \Rightarrow 12x^6$$

$$(iii) \frac{x^4 \cdot x^3 \cdot x^2}{x^9} \Rightarrow \frac{x^{4+3+2}}{x^9} = \frac{x^9}{x^9} = 1$$

$$(iv) (3x^2)^3 \Rightarrow 3x^6$$

$$(v) \sqrt{x} \cdot \sqrt{x} \Rightarrow (\sqrt{x})^2 = (x^{\frac{1}{2}})^2 = x^1 = x$$

2) Solve;

$$(i) \begin{aligned} 15x - 2 &= 12x + 9 \\ 15x - 12x &= 9 + 2 \\ 3x &= 11 \\ x &= \frac{11}{3} \end{aligned}$$

$$(ii) 3(4x - 1) = 6(x + 3)$$

$$21x - 3 = 6x + 18$$

$$21x - 6x = 18 + 3$$

$$15x = 21$$

$$x = \frac{21}{15} = \frac{7}{5}$$

$$(iii) \frac{5x+3}{4} = \frac{2x-1}{9}$$

$$45x + 27 = 8x - 4$$

$$45x - 8x = -4 - 27$$

$$37x = -31$$

$$x = -\frac{31}{37}$$

3) Solve;

$$(i) \begin{array}{r} x^2 + 10x + 21 = 0 \\ x \quad \times \quad +7 \\ x \quad \times \quad +3 \\ \hline (x+7)(x+3) = 0 \\ x_1 = -7 \quad x_2 = -3 \end{array}$$

$$(ii) \begin{array}{r} x^2 - 3x + 2 = 0 \\ x \quad \times \quad -2 \\ x \quad \times \quad -1 \\ \hline (x-2)(x-1) = 0 \\ x_1 = 2 \quad x_2 = 1 \end{array}$$

$$(iii) \begin{array}{r} x^2 + 12x + 20 = 0 \\ x \quad \quad +10 \\ x \quad \quad +2 \\ \hline (x+10)(x+2) = 0 \\ x_1 = -10 \quad x_2 = -2 \end{array}$$

$$(iv) \begin{aligned} x^2 - 64 &= 0 \\ x^2 &= 64 \quad 8^2 = 64 \\ x &= \pm 8 \\ x_1 &= -8 \\ x_2 &= 8 \end{aligned}$$

$$(v) \begin{array}{r} 2x^2 + 9x + 10 = 0 \\ 2x \quad \times \quad +2 \\ x \quad \times \quad +5 \\ \hline (2x+5)(x+2) = 0 \\ x_1 = -\frac{5}{2} \quad x_2 = -2 \end{array}$$

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$$4) \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$14x^2 + 3x = 11$$

$$14x^2 + 3x - 11 = 0$$

(a) (b) (c)

$$x = \frac{-3 \pm \sqrt{3^2 - 4 \cdot 14 \cdot (-11)}}{2 \cdot 14}$$

$$x = \frac{-3 \pm \sqrt{9 + 616}}{28} \quad \sqrt{625} = 25$$

$$x = \frac{-3 \pm \sqrt{625}}{28}$$

$$x_1 = \frac{-3 + 25}{28}$$

$$x_2 = \frac{-3 - 25}{28}$$

$$x_1 = \frac{11}{14}$$

$$x_2 = -1$$

$$5) \quad \begin{aligned} 5x + 3y &= 39 \quad (x2) \\ 8x - 2y &= 42 \quad (x3) \end{aligned}$$

$$\begin{aligned} 10x + 6y &= 78 \\ 24x - 6y &= 126 \\ \hline 34x &= 204 \\ x &= \frac{204}{34} \end{aligned}$$

$$x = 6$$

$$5 \cdot (6) + 3y = 39$$

$$30 + 3y = 39$$

$$3y = 39 - 30$$

$$3y = 9$$

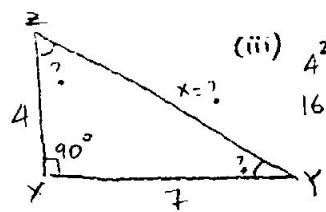
$$y = 3$$

$$\begin{aligned} 30 + 9 &= 39 \checkmark \\ (5 \cdot 6) + (3 \cdot 3) &= 39 \\ (8 \cdot 6) - (2 \cdot 3) &= 42 \\ 48 - 6 &= 42 \checkmark \end{aligned}$$

$$6) \text{ Simplify, } \underbrace{5(2x^2 - y^2)}_{(10x^2 - 5y^2)} - \underbrace{x^2(x^2 - y)}_{(-x^4 + x^2y)} - \underbrace{x^2y}_{x^2y} - \underbrace{x^4}_{x^4}$$

$$10x^2 - 5y^2 - x^4 + \cancel{x^2y} - \cancel{x^2y} - x^4$$

$$10x^2 - 5y^2 - 2x^4$$

7)  (iii) $\begin{aligned} 4^2 + 7^2 &= x^2 \\ 16 + 49 &= x^2 \\ 65 &= x^2 \\ x &= \sqrt{65} \approx 8.062 \end{aligned}$

$$8) \quad \begin{aligned} (i) \quad &3\sqrt{x} \\ \Rightarrow &3\sqrt{x} = x^{\frac{1}{2}} \end{aligned}$$

$$(ii) \quad 1$$

$$x^0 = 1$$

(i) Angle Y

$$\tan Y = \frac{4}{7}$$

$$Y = \tan^{-1}\left(\frac{4}{7}\right)$$

$$Y = 29.7^\circ \approx 30.0^\circ$$

(ii) Angle Z

$$\text{Angle } X = 90^\circ$$

$$\text{Angle } Y = 29.7^\circ$$

$$\Rightarrow 90^\circ + 29.7^\circ + Z^\circ = 180^\circ$$

$$Z^\circ = 60.3$$