| Simultaneous Equations (Linear and Non-Linear) Mark Scheme | | |
|---|---|---|
| **1** | $-x+2=x^2+2x-1$ | [1] Substitution |
| | $x^2+3x-3=0$ | [1] Rearrangement into quadratic format |
| | $x=-3.79, \quad y=5.79$ | [1] One set of correct answers |
| | $x=0.791, \quad y=1.21$ | [1] One set of correct answers |
| **2** | $x^2+\frac{(x+1)^2}{4}=9$ | [1] Substitution |
| | $4x^2+x^2+2x+1=36$<br>$5x^2+2x-35=0$ | [1] Rearrangement into quadratic format |
| | $x=-2.85, \quad y=-0.927$ | [1] One set of correct answers |
| | $x=2.45, \quad y=1.73$ | [1] One set of correct answers |
| **3** | $3x+x^2+2x-3=-9$ | [1] Substitution |
| | $x^2+5x+6=0$ | [1] Rearrangement into quadratic format |
| | $x=-3, \quad y=0$ | [1] One set of correct answers |
| | $x=-2, \quad y=-3$ | [1] One set of correct answers |
| **4** | $3x^2+2(3x-1)^2=35$ | [1] Substituting in for $y$ |
| | $3x^2+2(9x^2-6x+1)=35$<br>$21x^2-12x-33=0$<br>$7x^2-4x-11=0$ | [1] Simplifying |
| | $(7x-11)(x+1)=0$ | [1] Factorising |
| | $\therefore x=-1$ OR $x=\frac{11}{7}$ | [1] Solving for $x$ |
| | $\therefore y=-4$ OR $y=\frac{26}{7}$ | [1] Using $y=3x-1$ |
| | $(-1,-4)$ OR $(\frac{11}{7},\frac{26}{7})$ | [1] Correct pairings |
| **5(a)** | $3x^2+x(2-4x)+11=0$ | [1] Substitute in for $y$ |
| | $3x^2+2x-4x^2+11=0$<br>$-x^2+2x+11=0$<br>$x^2-2x-11=0$ | [1] Rearrangement to correct answer must be shown |

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| **5(b)** | $x = \frac{2 \pm \sqrt{(-2)^2 - 4(-11)}}{2}$ | [1] Solve using quadratic equation |
| | $x = \frac{2 \pm \sqrt{48}}{2}$<br>$x = \frac{2 \pm \sqrt{16 \times 3}}{2}$<br>$x = \frac{2 \pm 4\sqrt{3}}{2}$ | [1] Simplifying |
| | $\therefore x = 1 + 2\sqrt{3}$ OR $x = 1 - 2\sqrt{3}$ | [1] Cancelling factor of 2 |
| | $\therefore y = -2 - 8\sqrt{3}$ OR $y = -2 + 8\sqrt{3}$ | [1] Using $y = 2 - 4x$ |
| | $(1 + 2\sqrt{3}, -2 - 8\sqrt{3})$ OR $(1 - 2\sqrt{3}, -2 + 8\sqrt{3})$ | [1] Correct pairings |
| | | *Alternative method using complete the square* |
| | $x^2 - 2x - 11 = 0$<br>$(x - 1)^2 = 12$<br>$x = 1 \pm 2\sqrt{3}$ | [3] Simplify to find x using complete the square |
| | $\therefore y = -2 - 8\sqrt{3}$ OR $y = -2 + 8\sqrt{3}$ | [2] Using $y = 2 - 4x$ and $x = 1 \pm 2\sqrt{3}$ |
| | $(1 + 2\sqrt{3}, -2 - 8\sqrt{3})$ OR $(1 - 2\sqrt{3}, -2 + 8\sqrt{3})$ | [1] Correct pairings |
| **6** | $x^2 + (x - k)^2 - 9 = 0$ | [1] Substitute in $y = x - k$ |
| | $2x^2 - 2kx + (k^2 - 9) = 0$ | [1] Simplifying quadratic |
| | Hence solutions given by<br>$\therefore x = \frac{2k \pm \sqrt{(2k)^2 - 4 \times 2 \times (k^2 - 9)}}{4}$ | [1] Solving quadratic |
| | But there is only one. So therefore<br>$\sqrt{(2k)^2 - 4 \times 2 \times (k^2 - 9)} = 0$ | [1] Simplifying |
| | $\therefore (2k)^2 - 4 \times 2 \times (k^2 - 9) = 0$<br>$4k^2 - 8(k^2 - 9) = 0$<br>$4k^2 = 72$ | [1] Simplifying |
| | $\therefore k = \pm\sqrt{18} = \pm 3\sqrt{2}$ | [1] Getting to final answer with $\pm\sqrt{18}$ as a crucial step |
| | | |

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