Additional Mathematics

Chapter 2: Algebra II - Techniques

Chapter Assessment

1 Solve the following inequalities and represent their solutions on a number line.

(i) $3x + 4 < 7$ [2]

(ii) $\frac{(x-1)}{4} \geq 5$ [2]

(iii) $2 \leq 3x - 5 < 9$ [4]

2 Solve the following inequalities and represent their solutions on a number line.

(i) $x^2 - 7x + 12 < 0$ [4]

(ii) $x^2 - 4x + 3 > 0$ [5]

3 Simplify the following:

(i) $\frac{3(x+2)}{(8x+16)}$ [1]

(ii) $\frac{x}{3} + \frac{2x}{5}$ [2]

(iii) $\frac{2x+4}{x^2 - x - 6}$ [3]

(iv) $\frac{2}{x} - \frac{3}{x-1}$ [2]

4 Solve the equation: $\frac{6}{x} - \frac{2}{x+5} = 1$. [5]

5 Simplify the following:

(i) $\sqrt{128}$ [1]

(ii) $2\sqrt{27} - \sqrt{3}$ [2]

(iii) $\left(\sqrt{2} + \sqrt{3}\right)^2 + \left(\sqrt{2} - \sqrt{3}\right)^2$ [3]

6 Simplify the following by rationalising the denominator.

(i) $\frac{2}{\sqrt{2}}$ [1]

(ii) $\frac{3}{\sqrt{27}}$ [2]

7 Solve the quadratic equation: $x^2 + 3x - 7 = 0$, giving your answers exactly. [4]

8 Paul drives along a motorway for t hours and averages 90 km/h.
The following hour he only drives 30 km, as a result of which his average speed for the whole journey drops to 78 km/h.

(i) Write down the total distance travelled in the first t hours and $(t + 1)$ hours. [2]

(ii) Write down the average speed for the first $(t + 1)$ hours in terms of t.
Formulate an equation in t and solve it to find the value of t. [5]

9 A jackpot of £1540 is to be shared equally amongst the winners.
If the number of winners is increased by 3 then amount that each receives is reduced by £66.
Find the number of winners. [10]

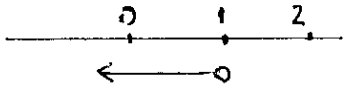
Total: 60

Additional Mathematics

Chapter 2: Algebra II – Techniques

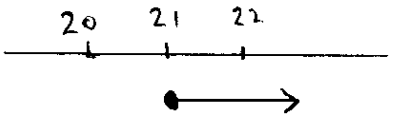
Chapter Assessment Solutions

1 (i) $3x + 4 < 7 \Rightarrow 3x < 3 \Rightarrow x < 1$ B1



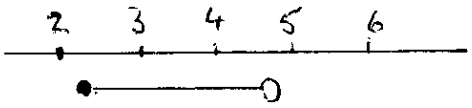
B1

(ii) $\frac{(x-1)}{4} \geqslant 5 \Rightarrow x - 1 \geqslant 20 \Rightarrow x \geqslant 21$ B1



B1

(iii) $2 \leqslant 3x - 5 < 9 \Rightarrow 7 \leqslant 3x < 14 \Rightarrow 7/3 \leqslant x < 14/3$ M1 A1

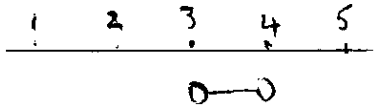


B1 B1

---

2 (i) $x^2 - 7x + 12 < 0 \Rightarrow (x-3)(x-4) < 0$ M1 A1

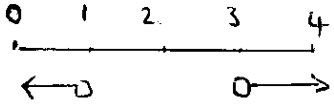
One must be -ve $\Rightarrow 3 < x < 4$ A1



B1

(ii) $x^2 - 4x + 3 > 0 \Rightarrow (x-3)(x-1) > 0$ M1 A1

Both must be +ve or both -ve $\Rightarrow x > 3$ or $x < 1$ A1 A1



B1

3 (i) $\frac{3(x+2)}{(8x+16)} = \frac{3(x+2)}{8(x+2)} = \frac{3}{8}$ B1

(ii) $\frac{x}{3} + \frac{2x}{5} = \frac{5x}{15} + \frac{6x}{15} = \frac{11x}{15}$ M1 (fw 15) A1

(iii) $\frac{2x+4}{x^2-x-6} = \frac{2(x+2)}{(x+2)(x-3)} = \frac{2}{x-3}$ M1 (Denominator) A1 A1

(iv) $\frac{2}{x} - \frac{3}{x-1} = \frac{2(x-1)-3x}{x(x-1)}$ M1

$= \frac{2x-2-3x}{x(x-1)} = \frac{-2-x}{x(x-1)}$ A1

4 $\frac{6}{x} - \frac{2}{x+5} = 1 \Rightarrow 6(x+5) - 2x = x(x+5)$ M1 A1

$\Rightarrow 4x + 30 = x^2 + 5x$ A1

$\Rightarrow x^2 + x - 30 = 0$

$\Rightarrow (x+6)(x-5) = 0$ M1

$\Rightarrow x = -6$ and 5 A1

5 (i) $\sqrt{128} = \sqrt{64 \times 2} = 8\sqrt{2}$ B1

(ii) $2\sqrt{27} - \sqrt{3} = 6\sqrt{3} - \sqrt{3} = 5\sqrt{3}$ M1 A1

(iii) $(\sqrt{2}+\sqrt{3})^2 + (\sqrt{2}-\sqrt{3})^2 = 2 + 2\sqrt{6} + 3 + 2 - 2\sqrt{6} + 3 = 10$ M1 – A1 A1

6 (i) $\frac{2}{\sqrt{2}} = \frac{2}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \sqrt{2}$ B1

(ii) $\frac{3}{\sqrt{27}} = \frac{3}{27}\sqrt{27} = \frac{1}{3}\sqrt{3}$ M1 A1

7 $x^2 + 3x - 7 = 0$

$\Rightarrow x = \frac{-3 \pm \sqrt{9+28}}{2} = \frac{-3 \pm \sqrt{37}}{2}$ M1 – A1 A1 A1

8 (i) Distance in t hours $= 90t$ B1

Distance in $t+1$ hours $= 90t + 30$ B2

(ii) Average for $t+1$ hours $= \frac{90t+30}{t+1} = 78$ M1 A1

$\Rightarrow 90t + 30 = 78t + 78$ A1

$\Rightarrow 12t = 48$

$\Rightarrow t = 4$ A1

9 Let there be n winners M1

Winnings $= \frac{1540}{n}$ A1

$\frac{1540}{n} - \frac{1540}{n+3} = 66$ M1 A1 A1

$1540(n+3) - 1540n = 66n(n+3)$ M1 A1

$\Rightarrow \frac{1540 \times 3}{66} = n^2 + 3n = 70$ A1

$\Rightarrow n^2 + 3n - 70 = 0 \Rightarrow (n+10)(n-7) = 0 \Rightarrow n = 7$ M1 A1