

**Surds Exam Questions MS (from OCR 4721)**

**Q1, (OCR Jan 2007, Q1)**

$$\frac{5}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}}$$

$$= \frac{5(2+\sqrt{3})}{4-3}$$

$$= 10+5\sqrt{3}$$

M1		Multiply top and bottom by $\pm(2+\sqrt{3})$
A1		$(2+\sqrt{3})(2-\sqrt{3}) = 1$ (may be implied)
A1	3 3	$10+5\sqrt{3}$

**Q2, (Jan 2009, Q1)**

$$3\sqrt{5} + \frac{20\sqrt{5}}{5}$$

$$= 7\sqrt{5}$$

B1		$3\sqrt{5}$ soi
M1		Attempt to rationalise $\frac{20}{\sqrt{5}}$
A1	3 <span style="border: 1px solid black; padding: 1px;">3</span>	cao

**Q3, (Jun 2009, Q2)**

$$\frac{(8+\sqrt{7})(2-\sqrt{7})}{(2+\sqrt{7})(2-\sqrt{7})}$$

$$= \frac{9-6\sqrt{7}}{4-7}$$

$$= -3+2\sqrt{7}$$

M1		Multiply numerator and denominator by conjugate
A1		Numerator correct and simplified
A1		Denominator correct and simplified
A1	4 <span style="border: 1px solid black; padding: 1px;">4</span>	cao

**Q4, (Jun 2010, Q3)**

(i)  $\frac{12(3-\sqrt{5})}{(3+\sqrt{5})(3-\sqrt{5})}$

$$= \frac{12(3-\sqrt{5})}{9-5}$$

$$= 9-3\sqrt{5}$$

M1		Multiply numerator and denom by $3-\sqrt{5}$
A1		$(3+\sqrt{5})(3-\sqrt{5}) = 9-5$
A1	3	

(ii)  $3\sqrt{2}-\sqrt{2}$

$$= 2\sqrt{2}$$

M1		Attempt to express $\sqrt{18}$ as $k\sqrt{2}$
A1	2 <span style="border: 1px solid black; padding: 1px;">5</span>	

**Q5, (Jun 2011, Q5)**

<p>(i) <math>10\sqrt{3} - 4\sqrt{3}</math></p> <p><math>= 6\sqrt{3}</math></p>	<p><b>M1</b> Attempt to express both surds in terms of <math>\sqrt{3}</math></p> <p><b>B1</b> One term correct</p> <p><b>A1</b> 3 Fully correct (not <math>\pm 6\sqrt{3}</math>)</p>
<p>(ii) <math>\frac{\sqrt{5}(15 + \sqrt{40})}{5}</math></p> <p><math>= \frac{15\sqrt{5} + 10\sqrt{2}}{5}</math></p> <p><math>= 3\sqrt{5} + 2\sqrt{2}</math></p>	<p><b>M1</b> Multiply numerator and denominator by <math>\sqrt{5}</math> or <math>-\sqrt{5}</math> or attempt to express both terms of numerator in terms of <math>\sqrt{5}</math> (e.g. dividing both terms by <math>\sqrt{5}</math>)</p> <p><b>B1</b> One of a, b correctly obtained</p> <p><b>A1</b> 3 Both a = 3 and b=2 correctly obtained</p> <p><b>6</b></p>

**Q6, (Jan 2012, Q1)**

<p><math>\frac{15 + \sqrt{3}}{3 - \sqrt{3}} \times \frac{3 + \sqrt{3}}{3 + \sqrt{3}}</math></p> <p><math>= \frac{48 + 18\sqrt{3}}{9 - 3}</math></p> <p><math>= 8 + 3\sqrt{3}</math></p>	<p><b>M1</b> Multiply top and bottom by <math>\pm(3 + \sqrt{3})</math></p> <p><b>A1</b> Numerator correct and simplified</p> <p><b>A1</b> Denominator correct and simplified to 6</p> <p><b>A1</b> cao</p> <p><b>[4]</b></p>
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**Q7, (Jun 2016, Q2)**

<p><math>\frac{3 + \sqrt{20}}{3 + \sqrt{5}} \times \frac{3 - \sqrt{5}}{3 - \sqrt{5}}</math></p> <p><math>\frac{-1 + 3\sqrt{5}}{9 - 5}</math></p> <p><math>-\frac{1}{4} + \frac{3}{4}\sqrt{5}</math></p>	<p><b>M1</b> Attempt to rationalise the denominator – must attempt to multiply</p> <p><b>B1</b> <math>\sqrt{20} = 2\sqrt{5}</math> soi</p> <p><b>A1</b> Either numerator or denominator correct and simplified to no more than two terms</p> <p><b>A1</b> Fully correct and fully simplified. Allow <math>\frac{-1 + 3\sqrt{5}}{4}</math>, order reversed etc.</p> <p><b>[4]</b> <b>Do not ISW</b> if then multiplied by 4 etc.</p>
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