Name: _____

Year 10 Advanced Mathematics Topic Test - Surds

SYDNEY GIRLS H.S.

Instructions to Students:

- Answer all questions on the question sheet.
- Calculators may be used.
- Poorly presented work will not be marked.
- Complete the test in pen.

1. Simplify $(2\sqrt{3})^2$

2. Simplify $\sqrt{52}$

3. Write $5\sqrt{68}$ in simplest form

4. Express $4\sqrt{7}$ as an entire surd

5. Simplify $\sqrt{13}\times\sqrt{6}$

6. Simplify $\sqrt{3}+7\sqrt{3}-5\sqrt{3}$

7. Simplify $9\sqrt{2}+8\sqrt{3}-9\sqrt{3}-8\sqrt{2}$

8. Simplify $\sqrt{27}+2\sqrt{3}$ completely

9. Simplify $5\sqrt{18}+\sqrt{72}-\sqrt{75}$ completely

10. Simplify $2\sqrt{x}\times 3\sqrt{x}$

11. Simplify $9\sqrt{12}\div 3\sqrt{6}$

12. Simplify fully $\dfrac{2\sqrt{3}\times 2\sqrt{6}}{4}$

13. Simplify fully $\dfrac{\sqrt{12}\times\sqrt{27}}{\sqrt{8}\times 2\sqrt{6}}$

14. Expand and simplify $2\sqrt{7}\left(\sqrt{7}-\sqrt{2}\right)$

15. Expand and simplify the following:

(a) $\left(\sqrt{2}+3\right)\left(\sqrt{2}+1\right)$

(b) $\left(3\sqrt{a}-2\sqrt{b}\right)\left(2\sqrt{a}+3\sqrt{b}\right)$

(c) $\left(\sqrt{2}+1\right)^2$

(d) $\left(\sqrt{2}+1\right)\left(\sqrt{2}-1\right)$

(e) $\left(2\sqrt{a}+3\sqrt{b}\right)\left(2\sqrt{a}-3\sqrt{b}\right)$

16. In each of the following, simplify fully and ensure you rationalise the denominator:

(a) $\dfrac{2}{\sqrt{11}}$

(b) $\dfrac{\sqrt{7}+\sqrt{3}}{2\sqrt{7}}$

(c) $\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{3}}$

(d) $\frac{\sqrt{2}}{\sqrt{5}}-\frac{\sqrt{3}}{\sqrt{2}}$

(e) $\frac{1}{1+\sqrt{2}}$

(f) $\frac{3\sqrt{2}-\sqrt{3}}{3\sqrt{2}+\sqrt{3}}$

(g) $\frac{5}{6-\sqrt{3}}+\frac{3}{5+\sqrt{3}}$

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1. Simplify $(2\sqrt{3})^2$

$(2\sqrt{3})^2 = (2\sqrt{3})(2\sqrt{3})$

$= 4 \times 3$ ✓

$= 12$ ✓

2. Simplify $\sqrt{52}$

$\sqrt{52} = \sqrt{4} \times \sqrt{13}$

$= 2\sqrt{13}$ ✓

3. Write $5\sqrt{68}$ in simplest form

$= 5 \times \sqrt{4} \times \sqrt{17}$

$= \sqrt{5 \times 2} \times \sqrt{17}$ ✓

$= 10\sqrt{17}$ ✓

4. Express $4\sqrt{7}$ as an entire surd

$4\sqrt{7} = \sqrt{4^2} \times \sqrt{7}$

$= \sqrt{16} \times \sqrt{7}$ ✓

$= \sqrt{112}$ ✓

5. Simplify $\sqrt{13} \times \sqrt{6}$

$= \sqrt{78}$ ✓

6. Simplify $\sqrt{3} + 7\sqrt{3} - 5\sqrt{3}$

$1\sqrt{3} + 7\sqrt{3} - 5\sqrt{3}$ ✓

$= 3\sqrt{3}$ ✓

7. Simplify $9\sqrt{2} + 8\sqrt{3} - 9\sqrt{3} - 8\sqrt{2}$

$= \sqrt{2} - \sqrt{3}$ ✓

8. Simplify $\sqrt{27} + 2\sqrt{3}$ completely

$\sqrt{27} + 2\sqrt{3} = \sqrt{3} \times \sqrt{9} + 2\sqrt{3}$

$= 3\sqrt{3} + 2\sqrt{3}$ ✓

$= 5\sqrt{3}$ ✓

9. Simplify $5\sqrt{18} + \sqrt{72} - \sqrt{75}$ completely

$= 5\sqrt{9} \times \sqrt{2} + \sqrt{36} \times \sqrt{2} - \sqrt{25} \times \sqrt{3}$

$= 3 \times 5\sqrt{2} + 6\sqrt{2} - 5\sqrt{3}$ ✓

$= 15\sqrt{2} + 6\sqrt{2} - 5\sqrt{3}$

$= 21\sqrt{2} - 5\sqrt{3}$ ✓

10. Simplify $2\sqrt{x} \times 3\sqrt{x}$

$6x$ ✓

11. Simplify $9\sqrt{12} \div 3\sqrt{6}$

$= 3\sqrt{2}$ ✓

12. Simplify fully $\frac{2\sqrt{3} \times 2\sqrt{6}}{4}$

$\frac{2\sqrt{18}}{4} = \sqrt{18}$

$= \frac{\sqrt{3} \times \sqrt{6}}{2}$

$= \frac{\sqrt{18}}{2} \Rightarrow \frac{\sqrt{9} \times \sqrt{2}}{2}$

$= \frac{3\sqrt{2}}{2}$ ✗

13. Simplify fully $\frac{\sqrt{12} \times \sqrt{27}}{\sqrt{8} \times 2\sqrt{6}}$

$= \frac{\sqrt{4} \times \sqrt{3} \times \sqrt{9} \times \sqrt{3}}{\sqrt{4} \times \sqrt{2} \times 2\sqrt{6}}$

$= \frac{2\sqrt{3} \times 3\sqrt{3}}{2\sqrt{2} \times 2\sqrt{6}}$

$= \frac{6 \times 3}{4\sqrt{12}}$

$= \frac{18}{4 \times 2\sqrt{3}} = \frac{18}{8\sqrt{3}} = \frac{9}{4\sqrt{3}}$

14. Expand and simplify $2\sqrt{7}(\sqrt{7} - \sqrt{2})$

$= (2\sqrt{7})(\sqrt{7}) - (2\sqrt{7})(\sqrt{2})$ ✓

$= 2 \times 7 - 2\sqrt{14}$

$= 14 - 2\sqrt{14}$ ✓

15. Expand and simplify the following:

(a) $(\sqrt{2} + 3)(\sqrt{2} + 1)$

$= \sqrt{2} \times \sqrt{2} + \sqrt{2} + 3\sqrt{2} + 3$ ✓

$= 2 + 4\sqrt{2} + 3$

$= 5 + 4\sqrt{2}$ ✓

(b) $(3\sqrt{a} - 2\sqrt{b})(2\sqrt{a} + 3\sqrt{b})$

$= 6a + 9\sqrt{ab} - 4\sqrt{ab} - 6b$ ✓

$= 6a - 6b + 5\sqrt{ab}$ ✓

(c) $(\sqrt{2} + 1)^2$

$= (\sqrt{2} + 1)(\sqrt{2} + 1)$

$= 2 + \sqrt{2} + \sqrt{2} + 1$ ✓

$= 3 + 2\sqrt{2}$ ✓

(d) $(\sqrt{2} + 1)(\sqrt{2} - 1)$

$= (\sqrt{2})^2 - 1^2$

$= 2 - 1$ ✓

$= 1$ ✓

(e) $(2\sqrt{a} + 3\sqrt{b})(2\sqrt{a} - 3\sqrt{b})$

$= (2\sqrt{a})^2 - (3\sqrt{b})^2$ ✓

$= 4a - 9b$ ✓

16. In each of the following, simplify fully and ensure you rationalise the denominator:

(a) $\frac{2 \times \sqrt{11}}{\sqrt{11} \times \sqrt{11}}$

$\frac{2\sqrt{11}}{11}$ ✓

(b) $\frac{\sqrt{7} + \sqrt{3}}{2\sqrt{7}} \times \frac{2\sqrt{7}}{2\sqrt{7}} = \frac{2 \times 7 + 2\sqrt{21}}{4 \times 7}$ ✓

$= \frac{14 + 2\sqrt{21}}{28}$

$= \frac{7 + \sqrt{21}}{14}$ ✓

(c) $\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{3}}$

$= \frac{\sqrt{2}}{\sqrt{2}\sqrt{2}} + \frac{\sqrt{3}}{\sqrt{3}\sqrt{3}}$

$= \frac{3\sqrt{2}}{6} + \frac{2\sqrt{3}}{6}$ ✓ $= \frac{3\sqrt{2}+2\sqrt{3}}{6}$

(d) $\frac{\sqrt{2}}{\sqrt{5}} - \frac{\sqrt{3}}{\sqrt{2}}$

$= \frac{\sqrt{10}}{5} - \frac{\sqrt{6}}{2}$

$= \frac{2\sqrt{10}}{10} - \frac{5\sqrt{6}}{10}$ ✓

(e) $\frac{1}{1+\sqrt{2}} \times \frac{1-\sqrt{2}}{1-\sqrt{2}}$

$= \frac{1-\sqrt{2}}{1+2}$ ✓

$= \frac{1-\sqrt{2}}{-1} = \sqrt{2}-1$

(f) $\frac{3\sqrt{2}-\sqrt{3}}{3\sqrt{2}+\sqrt{3}} \times \frac{3\sqrt{2}-\sqrt{3}}{3\sqrt{2}-\sqrt{3}}$

$= \frac{9\times 2 - 3\sqrt{6} - 3\sqrt{6} + 3}{9\times 2 - 3}$

$= \frac{18 - 6\sqrt{6} + 3}{18-3}$ ✓

$= \frac{21-6\sqrt{6}}{15} \div 3$

$= \frac{7-2\sqrt{6}}{5}$ ✓

(g) $\frac{5}{6-\sqrt{3}} + \frac{3}{5+\sqrt{3}}$

$= \frac{5(6+\sqrt{3})}{36-3} + \frac{3(5-\sqrt{3})}{25-3}$

$= \frac{30+5\sqrt{3}}{33} + \frac{15-3\sqrt{3}}{22}$ $= \frac{2(30+5\sqrt{3})}{66} + \frac{3(15-3\sqrt{3})}{66}$ ✓

$= \frac{60+10\sqrt{3}+45-9\sqrt{3}}{66}$

$= \frac{105-\sqrt{3}}{66}$ ✓