Name:

Exam Style Questions

Surds

Corbettmaths

Equipment needed: Pen

Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

Video Tutorial

www.corbettmaths.com/contents

Videos 305, 306, 307, 308

Answers and Video Solutions

$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

$\sqrt{a} \div \sqrt{b} = \sqrt{\frac{a}{b}}$

1. Evaluate the following

(a) $\sqrt{3} \times \sqrt{7}$

$\sqrt{21}$

.....

(1)

(b) $\sqrt{24} \div \sqrt{6}$ $= \sqrt{4}$

$= 2$

2

.....

(2)

(c) $2\sqrt{3} \times 3\sqrt{5}$ $= 6\sqrt{15}$

$6\sqrt{15}$

.....

(2)

(d) $10\sqrt{8} \div 2\sqrt{2}$ $= 5\sqrt{4}$

$= 5 \times 2$

$= 10$

10

.....

(2)

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

$\sqrt{3} \times \sqrt{3} = \sqrt{9}$

$= 3$

3

.....

(1)

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

3. Work out the exact value of $(\sqrt{2})^4$

$\sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2} = \sqrt{16}$

$= 4$

4

.....

(1)

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4. (a) Express $\sqrt{75}$ in its simplest form.

$\sqrt{25} \times \sqrt{3}$

$5\sqrt{3}$

$5\sqrt{3}$

.....

(1)

(b) Express $\sqrt{32}$ in its simplest form.

$\sqrt{16} \times \sqrt{2}$

$4\sqrt{2}$

$4\sqrt{2}$

.....

(1)

(c) Express $\sqrt{8}$ in its simplest form.

$\sqrt{4} \times \sqrt{2}$

$2\sqrt{2}$

$2\sqrt{2}$

.....

(1)

(d) Express $\sqrt{200}$ in its simplest form.

$\sqrt{100} \times \sqrt{2}$

$10\sqrt{2}$

.....

(1)

5. Simplify $\sqrt{5} \times \sqrt{10}$ $= \sqrt{50}$

$\sqrt{25} \times \sqrt{2}$

$5\sqrt{2}$

$5\sqrt{2}$

.....

(2)

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6. Simplify fully

(a) $\sqrt{50} + \sqrt{32}$

$(\sqrt{25} \times \sqrt{2}) + (\sqrt{16} \times \sqrt{2})$

$5\sqrt{2} + 4\sqrt{2}$

$= 9\sqrt{2}$

$9\sqrt{2}$

.....

(2)

(b) $\sqrt{80} + \sqrt{20}$

$(\sqrt{16} \times \sqrt{5}) + (\sqrt{5} \times \sqrt{4})$

$4\sqrt{5} + 2\sqrt{5} = 6\sqrt{5}$

$6\sqrt{5}$

.....

(2)

(c) $\sqrt{200} - \sqrt{72}$

$(\sqrt{100} \times \sqrt{2}) - (\sqrt{36} \times \sqrt{2})$

$10\sqrt{2} - 6\sqrt{2} = 4\sqrt{2}$

$4\sqrt{2}$

.....

(2)

$\sqrt{12} = \sqrt{4} \times \sqrt{3}$ $\sqrt{75} = \sqrt{25} \times \sqrt{3}$
$= 2\sqrt{3}$ $= 5\sqrt{3}$

(d) $3\sqrt{12} + \sqrt{75}$

$3(2\sqrt{3}) + 5\sqrt{3}$

$6\sqrt{3} + 5\sqrt{3} = 11\sqrt{3}$

$11\sqrt{3}$

(3)

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7. Tilly has been asked to work out $\sqrt{2} + \sqrt{8}$

Tilly says the answer is $\sqrt{10}$ as 2 + 8 = 10

Is Tilly correct?
Explain your answer.

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

$\sqrt{8} = \sqrt{4} \times \sqrt{2}$
$= 2\sqrt{2}$

No, $\sqrt{a} + \sqrt{b} \neq \sqrt{a+b}$
she should have simplified $\sqrt{8}$ to $2\sqrt{2}$, then added $\sqrt{2}$, to get $3\sqrt{2}$.

(2)

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8. Express $\sqrt{2} + \sqrt{98}$ in the form $a\sqrt{2}$ where a is an integer.

$\sqrt{98} = \sqrt{49} \times \sqrt{2}$
$= 7\sqrt{2}$

$\sqrt{2} + 7\sqrt{2} = 8\sqrt{2}$

$8\sqrt{2}$

(2)

9. Write $\sqrt{150}+\sqrt{24}$ in the form $k\sqrt{6}$

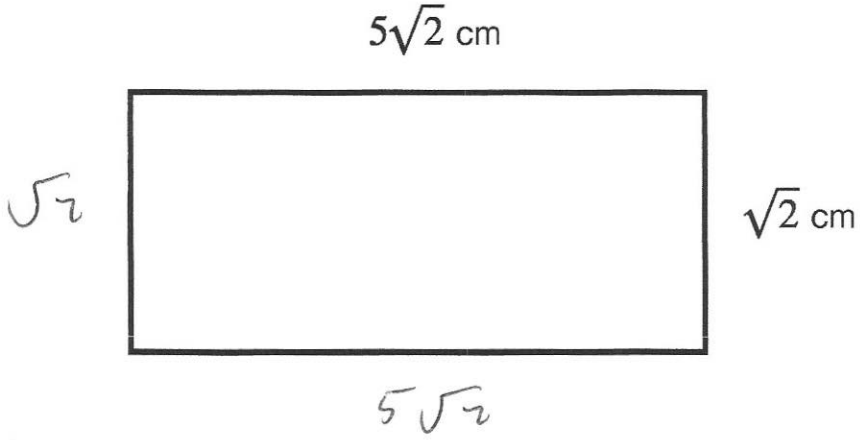
$(\sqrt{25}\times\sqrt{6})+(\sqrt{4}\times\sqrt{6})$

$5\sqrt{6}+2\sqrt{6}=7\sqrt{6}$

$7\sqrt{6}$

(2)

10. Shown below is a rectangle.



(a) Find the perimeter of the rectangle.

$5\sqrt{2}+\sqrt{2}+5\sqrt{2}+\sqrt{2}=12\sqrt{2}$

$12\sqrt{2}$ .....cm

(2)

(b) Find the area of the rectangle.

$5\sqrt{2}\times\sqrt{2}$

$=5\sqrt{4}$

$=5\times2$

$=10$

10 .....cm²

(2)

11. Write each of these in the form $a\sqrt{3}$, where a is an integer.

(a) $\sqrt{6} \times \sqrt{8}$ $= \sqrt{48}$

$\sqrt{16} \times \sqrt{3}$

$4\sqrt{3}$

$4\sqrt{3}$

(2)

(b) $\sqrt{27} + \sqrt{75}$

$(\sqrt{9} \times \sqrt{3}) + (\sqrt{25} \times \sqrt{3})$

$3\sqrt{3} + 5\sqrt{3} = 8\sqrt{3}$

$8\sqrt{3}$

(2)

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12. Rationalise the denominator of $\frac{15}{\sqrt{5}}$ $\times\sqrt{5}$ $\times\sqrt{5}$

$\frac{15\sqrt{5}}{5} = 3\sqrt{5}$

$3\sqrt{5}$

(2)

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13. Simplify fully $\sqrt{600} + \sqrt{24}$

$(\sqrt{100} \times \sqrt{6}) + (\sqrt{4} \times \sqrt{6})$

$10\sqrt{6} + 2\sqrt{6} = 12\sqrt{6}$

$12\sqrt{6}$

(2)

14. (a) Rationalise the denominator of $\frac{12}{\sqrt{3}}$

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

$= 4\sqrt{3}$

$4\sqrt{3}$

.....

(2)

(b) Evaluate $\sqrt{2} \times \sqrt{32}$

$= \sqrt{64}$

$= 8$

8

.....

(2)

(c) Expand and simplify $(\sqrt{3} + \sqrt{5})^2$

$(\sqrt{3} + \sqrt{5})(\sqrt{3} + \sqrt{5})$

$3 + \sqrt{15} + \sqrt{15} + 5$

$8 + 2\sqrt{15}$

$8 + 2\sqrt{15}$

.....

(2)

(d) Evaluate $(5 + \sqrt{2})(5 - \sqrt{2})$

$25 - 5\sqrt{2} + 5\sqrt{2} - 2$

23

23

.....

(2)

15. (a) Simplify fully $\sqrt{3}(\sqrt{27}-\sqrt{3})$

$\sqrt{81} - \sqrt{9}$

$9 - 3 = 6$

6

.....

(2)

(b) Given that $a = \sqrt{2}$ $b = \sqrt{15}$ $c = \sqrt{30}$

work out the value of

$$\frac{b}{ac}$$

write your answer in its simplest form

$\frac{\sqrt{15}}{\sqrt{2} \times \sqrt{30}} = \frac{\sqrt{15}}{\sqrt{60}}$

$= \frac{\sqrt{15}}{\sqrt{4} \times \sqrt{15}}$

$\frac{1}{\sqrt{4}} = \frac{1}{2}$

$\frac{1}{2}$

.....

(3)

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16. Rationalise the denominator of

$$\frac{12}{7\sqrt{3}} \quad \times\sqrt{3} \quad \times\sqrt{3}$$

$\frac{12\sqrt{3}}{7 \times 3}$

$= \frac{12\sqrt{3}}{21}$

$= \frac{4\sqrt{3}}{7}$

$\frac{4\sqrt{3}}{7}$

.....

(2)

17. Given that a = $\sqrt{3}$ and b = $\sqrt{48}$

(a) find the value of a^2

3

.....

(1)

(b) show that $(a+b)^2 = 75$

$(\sqrt{3} + \sqrt{48})(\sqrt{3} + \sqrt{48})$

$3 + \sqrt{144} + \sqrt{144} + 48$

$3 + 12 + 12 + 48$

75

.....

(3)

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18. Expand and simplify $(3+\sqrt{8})(4+\sqrt{2})$

Give your answer in the form $a + b\sqrt{2}$ where a and b are integers.

$12 + 3\sqrt{2} + 4\sqrt{8} + \sqrt{16}$

$12 + 3\sqrt{2} + 4(\sqrt{4} \times \sqrt{2}) + 4$

$12 + 3\sqrt{2} + 4(2\sqrt{2}) + 4$

$12 + 3\sqrt{2} + 8\sqrt{2} + 4$

$16 + 11\sqrt{2}$

$16 + 11\sqrt{2}$

.....

(4)

19. Simplify $5\sqrt{8}+\sqrt{18}$

$5(\sqrt{4}\times\sqrt{2})+(\sqrt{9}\times\sqrt{2})$

$5(2\sqrt{2})+3\sqrt{2}$

$10\sqrt{2}+3\sqrt{2}=13\sqrt{2}$

$13\sqrt{2}$

.....

(2)

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20. Rationalise the denominator of

$\frac{8}{\sqrt{2}} \times\frac{\sqrt{2}}{\sqrt{2}} = \frac{8\sqrt{2}}{2}$

$=4\sqrt{2}$

$4\sqrt{2}$

.....

(2)

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21. Expand and simplify $(\sqrt{7}-\sqrt{3})^2$

$(\sqrt{7}-\sqrt{3})(\sqrt{7}-\sqrt{3})$

$7-\sqrt{21}-\sqrt{21}+3$

$10-2\sqrt{21}$

$10-2\sqrt{21}$

.....

(2)

22. Write $\sqrt{11}+\sqrt{99}$ in the form $a\sqrt{b}$ where a and b are integers.

$\sqrt{11} + (\sqrt{9} \times \sqrt{11})$

$\sqrt{11} + 3\sqrt{11} = 4\sqrt{11}$

$4\sqrt{11}$

(2)

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23. Expand $(8-\sqrt{3})^2$ giving your answer in form $a+b\sqrt{3}$

$(8-\sqrt{3})(8-\sqrt{3})$

$64 - 8\sqrt{3} - 8\sqrt{3} + 3$

$67 - 8\sqrt{3} - 8\sqrt{3}$

$67 - 16\sqrt{3}$

$67 - 16\sqrt{3}$

(2)

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24. Show that $(\sqrt{2}+3\sqrt{8})^2 = 98$

$(\sqrt{2} + 3\sqrt{8})(\sqrt{2} + 3\sqrt{8})$

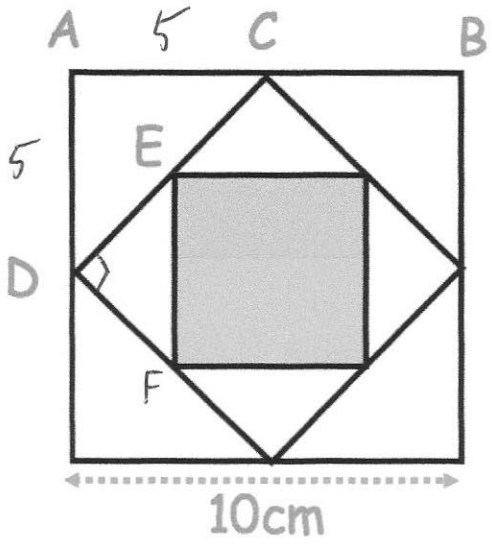
$2 + 3\sqrt{16} + 3\sqrt{16} + 9\sqrt{64}$

$2 + 12 + 12 + 72 = 98$

98

(3)

25. The midpoints of the sides of a square of side 10cm are joined to form another square.
This process is then repeated to create the shaded square.



Find the area of the shaded square.

$CD^2 = AD^2 + AC^2$

$CD^2 = 5^2 + 5^2$

$CD^2 = 50$

$CD = \sqrt{50}$

$DE = CD \div 2 = \frac{\sqrt{50}}{2}$

$EF^2 = DE^2 + DF^2$

$EF^2 = \left(\frac{\sqrt{50}}{2}\right)^2 + \left(\frac{\sqrt{50}}{2}\right)^2$

$= \frac{50}{4} + \frac{50}{4} = \frac{100}{4}$

$EF^2 = 25$

$EF = 5$

$5 \times 5 = 25$

25 .....cm²

(4)

26. Simplify $\sqrt{80} - \dfrac{10}{\sqrt{5}}$

$\sqrt{16} \times \sqrt{5} - \dfrac{10}{\sqrt{5}} \times \sqrt{5}$

$4\sqrt{5} - \dfrac{10\sqrt{5}}{5}$

$4\sqrt{5} - 2\sqrt{5} = 2\sqrt{5}$

$2\sqrt{5}$

.....

(3)

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27. Given that

$$\frac{10 - \sqrt{32}}{\sqrt{2}} = a + b\sqrt{2}$$

where a and b are integer.

Find the values of a and b.

$\dfrac{\sqrt{2}(10 - \sqrt{32})}{2}$

$\dfrac{10\sqrt{2} - \sqrt{64}}{2}$

$\dfrac{10\sqrt{2} - 8}{2}$

$= 5\sqrt{2} - 4$

$-4 + 5\sqrt{2}$

a = -4

b = 5

(4)

28. A shed has dimensions, in metres, of

Height = $\sqrt{5}$ Width = $\sqrt{6}$ Length = $\frac{9}{\sqrt{2}}$

Find the volume of the shed.
Give your answer in the form $a\sqrt{15}$, where a is an integer.

$\sqrt{5} \times \sqrt{6} \times \frac{9}{\sqrt{2}}$

$\sqrt{30} \times \frac{9}{\sqrt{2}}$

$\frac{9\sqrt{30}}{\sqrt{2}} = 9\sqrt{15}$

$9\sqrt{15}$ .....m³

(3)

29. (a) Simplify $\sqrt{2}y + \sqrt{2}y + \sqrt{2}y$

$3\sqrt{2}y$ .....

(1)

(b) Simplify fully $\sqrt{2}y \times \sqrt{2}y \times \sqrt{2}y$

$\sqrt{2} \times \sqrt{2} \times \sqrt{2} = \sqrt{8}$
$= 2\sqrt{2}$

$2\sqrt{2}y^3$ .....

(2)

30. $c = \dfrac{9}{2\sqrt{y}}$ $\quad d = \dfrac{4}{\sqrt{y}}$

Work out cd

$\frac{9}{2\sqrt{y}} \times \frac{4}{\sqrt{y}} = \frac{36}{2y}$

$= \frac{18}{y}$

$\frac{18}{y}$

.....

(3)

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31. $y = \dfrac{4\sqrt{10}}{5}$

Work out the value of y^3

$\frac{4\sqrt{10}}{5} \times \frac{4\sqrt{10}}{5} \times \frac{4\sqrt{10}}{5}$

$\sqrt{1000} = \sqrt{100} \times \sqrt{10}$

$= 10\sqrt{10}$

$\frac{64\sqrt{1000}}{125}$

$125 \div 5 = 25$

$640 \div 5 = 128$

$\frac{64 \times 10\sqrt{10}}{125} = \frac{640\sqrt{10}}{125}$

$= \frac{128\sqrt{10}}{25}$

$\frac{128\sqrt{10}}{25}$

.....

(3)

32. $(3+c\sqrt{5})^2 = d + 24\sqrt{5}$

Work out the values of c and d.

$(3+c\sqrt{5})(3+c\sqrt{5})$

$= 9 + 3c\sqrt{5} + 3c\sqrt{5} + 5c^2$

$= 9 + 5c^2 + 6c\sqrt{5}$

$6c = 24$

$c = 4$

$9 + 5 \times 4^2$

$9 + 80 = 89$

c = 4

d = 89

(4)

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33. $\sqrt{300} - 2\sqrt{x} = 4\sqrt{3}$

Work out the value of x

$\sqrt{100} \times \sqrt{3} - 2\sqrt{x} = 4\sqrt{3}$

$10\sqrt{3} - 2\sqrt{x} = 4\sqrt{3}$

$2\sqrt{x} = 6\sqrt{3}$

$\sqrt{x} = 3\sqrt{3}$

$\sqrt{x} = \sqrt{27}$

$x = 27$

27

(3)

34. Given that

$$\sqrt{1\frac{2}{25}} + \sqrt{12} = \frac{a\sqrt{3}}{b}$$

Work out the values of a and b

$\sqrt{\frac{27}{25}} + \sqrt{12} = \frac{a\sqrt{3}}{b}$

$\sqrt{9} \times \sqrt{3}$ → $3\sqrt{3}$

$\frac{\sqrt{27}}{\sqrt{25}} + (\sqrt{4} \times \sqrt{3}) = \frac{a\sqrt{3}}{b}$

$\frac{3\sqrt{3}}{5} + 2\sqrt{3} = \frac{a\sqrt{3}}{b}$

$\frac{3}{5} + \frac{2}{1}$

$\frac{3}{5} + \frac{10}{5} = \frac{13}{5}$

$a = 13 \quad b = 5$

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(3)

35. Write

$$\frac{4}{\sqrt{5}} - \sqrt{2\frac{2}{9}}$$ in the form $a\sqrt{5}$

$\frac{4}{\sqrt{5}} - \sqrt{\frac{20}{9}}$

$\frac{4\sqrt{5}}{5} - \frac{\sqrt{20}}{\sqrt{9}}$

$\sqrt{4} \times \sqrt{5}$ → $2\sqrt{5}$

$\frac{4\sqrt{5}}{5} - \frac{\sqrt{20}}{3}$

$\frac{4\sqrt{5}}{5} - \frac{2\sqrt{5}}{3}$

$\frac{12\sqrt{5}}{15} - \frac{10\sqrt{5}}{15}$

$\frac{2}{15}\sqrt{5}$

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(4)

36. Write $\dfrac{6}{\frac{1}{\sqrt{2}}+\sqrt{2}}$ in the form $a\sqrt{2}$

$\frac{\sqrt{2}}{2}$

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

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

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

$= 2\sqrt{2}$

$2\sqrt{2}$

.....

(4)

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37. Show that $\dfrac{16}{\sqrt{11}-3}$ can be written in the form $a+b\sqrt{11}$

$\frac{16}{\sqrt{11}-3} \times \frac{(\sqrt{11}+3)}{(\sqrt{11}+3)}$

$(\sqrt{11}-3)(\sqrt{11}+3)$

$11 + 3\sqrt{11} - 3\sqrt{11} - 9$

2

$\frac{16(\sqrt{11}+3)}{2}$

$8(\sqrt{11}+3)$

$8\sqrt{11} + 24$

$24 + 8\sqrt{11}$

.....

(4)

38. Show that $\frac{6}{2-\sqrt{3}}$ can be written in the form $a+b\sqrt{3}$

$\frac{6}{2-\sqrt{3}} \times \frac{(2+\sqrt{3})}{(2+\sqrt{3})} = \frac{6(2+\sqrt{3})}{1}$

$= 12+6\sqrt{3}$

$12+6\sqrt{3}$

.....

(4)

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39. Write $\frac{4\sqrt{2}}{3+\sqrt{2}}+\frac{6}{\sqrt{2}}$ in the form $\frac{a\sqrt{2}-b}{c}$

$\frac{4\sqrt{2}}{3+\sqrt{2}} + \frac{6}{\sqrt{2}}$

$\frac{4\sqrt{2}(3-\sqrt{2})}{(3+\sqrt{2})(3-\sqrt{2})} + \frac{6\sqrt{2}}{2}$

$\frac{12\sqrt{2}-8}{7} + \frac{3\sqrt{2}}{1}$

$\frac{12\sqrt{2}-8}{7} + \frac{21\sqrt{2}}{7} = \frac{33\sqrt{2}-8}{7}$

.....

(4)

40. Write $\dfrac{\sqrt{2}-2}{3\sqrt{2}+4}$ in the form $a+b\sqrt{2}$, where a and b are integers.

$$\frac{\sqrt{2}-2}{3\sqrt{2}+4} \times \frac{(3\sqrt{2}-4)}{(3\sqrt{2}-4)} = \frac{6-4\sqrt{2}-6\sqrt{2}+8}{18-16}$$

$$= \frac{14-10\sqrt{2}}{2}$$

$$= 7-5\sqrt{2}$$

$7-5\sqrt{2}$

.....

(4)