$\sqrt{48}$ or $k = 48$

*ft value seen in the form* $a\sqrt{b}$ *where a and b are integers > 1*

**B1ft**

**[3]**

**M2.**

$\frac{10}{3\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ or $\frac{10\sqrt{5}}{15}$

$\frac{10}{3\sqrt{5}} \times \frac{3\sqrt{5}}{3\sqrt{5}}$ or $\frac{30\sqrt{5}}{45}$

or $\frac{\sqrt{20}}{3}$

*oe*

*Must multiply numerator and denominator*

*eg* $\frac{10}{\sqrt{45}}$ *is M0*

$\frac{10}{\sqrt{45}} \times \frac{\sqrt{45}}{\sqrt{45}}$ *is M1*

**M1**

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

**A1**

**[2]**

**M3.**

(a) $6\sqrt{2}$

**B1**

(b) $\sqrt{\frac{24}{6}}$ or $\sqrt{\frac{8}{2}}$ or $\sqrt{4}$

or $\frac{\sqrt{8}}{\sqrt{2}}$ or $\frac{2\sqrt{2}}{\sqrt{2}}$

or $\frac{\sqrt{8} \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}}$ or $\frac{\sqrt{16}}{2}$ or $\frac{4}{2}$

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

or $\frac{\sqrt{3} \times 2\sqrt{2} \times \sqrt{2}}{\sqrt{6} \times \sqrt{2}}$ or $\frac{2\sqrt{12}}{\sqrt{12}}$

or $\frac{\sqrt{3} \times \sqrt{8} \times \sqrt{6}}{\sqrt{6} \times \sqrt{6}}$ or $\frac{\sqrt{24} \times \sqrt{6}}{\sqrt{6} \times \sqrt{6}}$

or $\frac{\sqrt{144}}{6}$ or $\frac{12}{6}$

**M1**

2

**A1**

**Additional Guidance**

$\frac{\sqrt{24}}{\sqrt{6}}$ does not score alone without further working

**M0**

**[3]**

**M4.**

**Alternative method 1**

Correct order **and** all three correct values $\sqrt{20}$, $\sqrt{24}$ and $\sqrt{28}$

*B2 three correct values $\sqrt{24}$, $\sqrt{28}$ and $\sqrt{20}$*

*or $\sqrt{20}$ and $\sqrt{24}$*

*or $\sqrt{20}$ and $\sqrt{28}$*

*or $\sqrt{24}$ and $\sqrt{28}$*

*B1 $\sqrt{20}$ or $\sqrt{24}$ or $\sqrt{28}$*

**B3**

**Alternative method 2**

Correct order **and** all three correct values $2\sqrt{5}$, $2\sqrt{6}$ and $2\sqrt{7}$

*B2 three correct values $2\sqrt{6}$, $2\sqrt{7}$ and $2\sqrt{5}$*

*or $2\sqrt{5}$ and $2\sqrt{6}$*

*or $2\sqrt{5}$ and $2\sqrt{7}$*

*or $2\sqrt{6}$ and $2\sqrt{7}$*

*B1 $2\sqrt{5}$ or $\frac{10\sqrt{5}}{5}$ or $2\sqrt{6}$ or $2\sqrt{7}$*

**B3**

**Alternative method 3**

Correct order **and** all three correct values 20, 24 and 28

*B2 three correct values 24, 28 and 20*

*or 20 and 24*

*or 20 and 28*

*or 24 and 28*

*B1 20 or $\frac{100}{5}$ or 24 or $4 \times 3 \times 2$*

*or $12 \times 2$ or $8 \times 3$ or $4 \times 6$ or 28*

**B3**

**Additional Guidance**

Correct order is $\frac{10}{\sqrt{5}}$, $2\sqrt{3} \times \sqrt{2}$, $\sqrt{\frac{56}{2}}$

20, 24, 28 using Alt 3

**B2**

B1 values using Alt 3 can be seen inside square root

$\sqrt{\frac{100}{5}}$ or $\sqrt{4 \times 3 \times 2}$ or $\sqrt{12 \times 2}$ or $\sqrt{8 \times 3}$ or $\sqrt{4 \times 6}$

**B1**

**[3]**

**M5.**(a) Sight of $x^2$, $-xy$, $+xy$ and $-y^2$ plus some indication that $xy$ terms cancel.

Eg $x^2 - \cancel{xy} + \cancel{xy} - y^2$

Minimum would be

$x^2 - xy + xy - y^2 = x^2 - y^2$

**B1**

(b) $\frac{1}{2} \times 5\sqrt{2} \times (\sqrt{3} - 1) \times \frac{\sqrt{3}+1}{2\sqrt{2}}$

*Correct substitution into ½ $ab\sin C$*

**B1**

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

*This must be evaluated at some stage*

**B1**

Clear indication that the expression cancels down to a fraction equivalent to $\frac{5}{2}$

*Must show or state cancelling (strand(ii)) for justifying a result.*

*Cancelling can be done at any stage*

**Q1**

**Alternative method**

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

*Must get this correct to show explicitly or implicitly (eg could rationalise denominator) that $(\sqrt{3} - 1)(\sqrt{3} + 1) = 3 - 1 (= 2)$*

**B1**

$\frac{1}{2} \times 5\sqrt{2}$ × their $\frac{1}{\sqrt{2}}$

**B1ft**

Clear indication that the expression cancels down to a fraction equivalent to $\frac{5}{2}$

*Must show or state cancelling (strand(ii)) for justifying a result.*

*Cancelling can be done at any stage*

**Q1**

**[4]**

**M6.** $(\sqrt{10} =)\sqrt{5}\times\sqrt{2}$ or $\sqrt{5\times2}$

or $(\sqrt{20} =)\sqrt{5}\times\sqrt{4}$ or $\sqrt{5\times4}$ or $2\sqrt{5}$

or $3\sqrt{200}$ or $3\sqrt{100\times2}$

or $3\sqrt{10\times10\times2}$ or $3\sqrt{25\times8}$

or $3\sqrt{5\times5\times8}$ or $3\sqrt{25\times2\times2\times2}$

or $3\sqrt{5\times5\times2\times2\times2}$

or $(3\sqrt{20} =)6\sqrt{5}$ or $3\times2\sqrt{5}$

or $6\sqrt{50}$ or $7\sqrt{50}$

or $(\sqrt{50} =)\sqrt{25}\times\sqrt{2}$ or $\sqrt{5\times5\times2}$ or $5\sqrt{2}$

*oe*

**M1**

$30\sqrt{2}$ or $3\times10\sqrt{2}$

or $35\sqrt{2}$ or $7\times5\sqrt{2}$

or $13\sqrt{50}$ or $\sqrt{10}\times13\sqrt{5}$

*oe*

**M1dep**

65

*allow* $65\sqrt{2}$

**A1**

**Additional Guidance**

First method mark is for any useful first step

**[3]**

**M7.**

(a) $(\cos B =)\dfrac{(3\sqrt{2})^2 + (\sqrt{2})^2 - (\sqrt{14})^2}{2 \times 3\sqrt{2} \times \sqrt{2}}$

*$(\sqrt{14})^2 = (3\sqrt{2})^2 + (\sqrt{2})^2 - 2 \times 3\sqrt{2} \times \sqrt{2} \times \cos B$*

**M1**

$\dfrac{18 + 2 - 14}{2 \times 3 \times 2}$

*$14 = 18 + 2 - 12 \times \cos B$*

*allow one error*

*oe*

**M1dep**

$\cos B = \dfrac{6}{12} = \dfrac{1}{2}$ and $B = 60°$

or $(B =) \cos^{-1}(½) = 60°$

**A1**

(b) $\sin 60 = \dfrac{\sqrt{3}}{2}$ seen

**M1**

$\dfrac{1}{2} \times 3\sqrt{2} \times \sqrt{2} \times \sin 60$

*oe*

**B1**

$\dfrac{3\sqrt{3}}{2}$

*oe*

**A1**

**[6]**

**M8.**(a) $\sqrt{25}\sqrt{3}$ or $\sqrt{(25\times3)}$

$\sqrt{5}\times\sqrt{5}\times\sqrt{3}$ or $\sqrt{(5^2\times3)}$

**B1**

**Alternative Method**

$(5\sqrt{3})^2 = 25 \times 3$

**B1**

(b) $\frac{6\sqrt{3}}{3}$ or $\frac{6\sqrt{3}}{\sqrt{3}\times\sqrt{3}}$ or $\sqrt{12}$

**M1**

$2\sqrt{3}$

**A1**

(c) $(5\sqrt{3} + 5\sqrt{3}$ + their $2\sqrt{3}) \div 3$

**M1**

*Must use $5\sqrt{3}$ + not $\sqrt{75}$*

*Condone missing brackets.*

*Working must be seen as answer can be obtained from wrong work.*

$4\sqrt{3}$

*ft on their answer to (b) if of form $a\sqrt{3}$ accuracy to 2 dp.*

**A1ft**

**[5]**

**M9.**(a) $9^{\sqrt{2}}$

**B1**

(b) 10

**B1**

**[2]**

**M10.**(a) $\sqrt{4}$

$\frac{2\sqrt{2}}{\sqrt{2}}$ *or* $\frac{\sqrt{8}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$ *or* $\sqrt{\frac{8}{2}}$ *or* $\sqrt{\frac{4}{1}}$ *or* $\frac{\sqrt{16}}{2}$

*or* $\frac{\sqrt{8}\ \sqrt{2}}{2}$ *or* $\frac{2}{1}$

**M1**

2

**A1**

(b) two correct steps

*eg two of:*

$\sqrt{4} = 2$ *or* $\sqrt{1} = 1$ *or cancels* $\sqrt{5}$ *or combines any two surds*

**M1**

$\sqrt{144}$

**M1**

*oe eg* $\sqrt{12}\ \sqrt{12}$ *or* $\sqrt{4}\ \sqrt{36}$

*k*= 12

**A1**

**[5]**

**M11.**(a) $\sqrt{8 \times 2}$ or $\sqrt{16}$ or $2\sqrt{2}$ (× $\sqrt{2}$ )

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

**M1**

4

*Accept – 4*

**A1**

(b) $\frac{12}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

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

**M1**

$4\sqrt{3}$

**A1**

**[4]**

**M12.**

√500 = 10√5 or √45 = 3√5

*or for 5√4√5 and 2√9√5*

**M1**

4√5

**A1**

**[2]**

**M13.**

(a) $\sqrt{2 \times 32}$ or $\sqrt{64}$ or

$(\sqrt{2} \times)4\sqrt{2}$ or $2\sqrt{16}$ or

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

**M1**

8

**A1**

)

(b) $\frac{21\sqrt{7}}{\sqrt{7}\sqrt{7}}$ or $\frac{21\sqrt{7}}{7}$ or $\frac{21\sqrt{7}}{\sqrt{49}}$

**M1**

$3\sqrt{7}$

**A1**

**[4]**

**M14.**

$\sqrt{36}$ or 6

or

$(\sqrt{3}\times)2\sqrt{3}$

**M1**

$\frac{1}{5^2}$ or $\frac{1}{25}$ or 0.04

$\frac{6}{25}$ *is M1M1*

**M1**

0.24

**A1**

**[3]**