$\sqrt{48}$ 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 12×2 or 8×3 or 4×6 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 $x2 - xy + xy - y2$

Minimum would be

$x2 - xy + xy - y2 = x2 - y$

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 $\sqrt{5 \times 2}$

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

or $3\sqrt{200}$ or $3\sqrt{100 \times 2}$

or $3\sqrt{10 \times 10 \times 2}$ or $3\sqrt{25 \times 8}$

or $3\sqrt{5 \times 5 \times 8}$ or $3\sqrt{25 \times 2 \times 2 \times 2}$

or $3\sqrt{5 \times 5 \times 2 \times 2 \times 2}$

or $(3\sqrt{20} =)6\sqrt{5}$ or $3 \times 2\sqrt{5}$

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

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

oe

M1

$30\sqrt{2}$ or $3 \times 10\sqrt{2}$

or $35\sqrt{2}$ or $7 \times 5\sqrt{2}$

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

oe

M1dep

65

allow $65\sqrt{2}$

A1

Additional Guidance

First method mark is for any useful first step

[3]

M7.

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

(√14)² = (3√2)² + (√2)² – 2 × 3√2 ×√2 × cos B

M1

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

14 = 18 + 2 – 12 × 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 √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√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) $\sqrt{8\times2}$ or $\sqrt{16}$ or $2\sqrt{2}$ (× $\sqrt{2}$)

or $\sqrt{2\times2\times2\times2}$ or $\sqrt{4\times4}$

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]