

Mark schemes

Q1.

Correct evaluation of a relevant power of 2 or 16

$$\text{eg } 16^{\frac{1}{2}} = (\pm) 4 \text{ or } 16 = 256^{\frac{1}{2}} \text{ or } 24 = 16 \text{ or}$$

or $4^c = d$

$$16^{\frac{1}{4}} = (\pm) 2 \text{ or } 16^1 = 16 \text{ or } 16^0 = 1$$

M1

One correct pair of answers

A correct answer is such that $d = 4c$

A1

A second correct pair of answers

eg $c = 0, d = 0$

$c = 1, d = 4$ or $c = -1, d = -4$

$c = 2, d = 8$ or $c = \frac{1}{8}, d = \frac{1}{2}$ etc ...

A1

[3]

Q2.

(a) $\frac{1}{81^{\frac{1}{4}}}$ or $\frac{1}{\sqrt[4]{81}}$ or $\sqrt[4]{\frac{1}{81}}$
 or 3^{-1} or $9^{\frac{1}{2}}$
 or $81^{\frac{1}{4}} = 3$ or $\sqrt[4]{81} = 3$
 or $3^4 = 81$

M1

$$\frac{1}{3}$$

A1

Additional Guidance

3 without $81^{\frac{1}{4}}$ or $\sqrt[4]{81}$

M0A0

(b) Alternative method 1

(16 =) 24

or (23)2x or 26

oe with consistent base 2

M1dep

$$(16 =) 2^4 \text{ and } (2^{32x}) \text{ or } 2^{6x}$$

M1dep

$$2^{4+6x} \text{ or } 2^{2(2+3x)}$$

A1

Alternative method 2

$$((4 \times 8x)^2 =) (2^2 \times 2^3x)$$

M1

$$(2^{2+3x})^2$$

M1dep

$$2^{4+6x} \text{ or } 2^{2(2+3x)}$$

oe index

A1

[5]

Q3.

16

$$\text{B1 for } 64^{\frac{1}{3}} = 4$$

$$\text{B1 for } \sqrt[3]{64 \times 64}$$

$$\text{B1 for } \left(64^{\frac{1}{3}}\right)^2 \text{ oe}$$

$$\text{B1 for } \left(64^2\right)^{\frac{1}{3}} \text{ oe}$$

B2

[2]

Q4.

(a) $\frac{1}{27}$

$$\text{B2 for } 27 \text{ or } \frac{1}{3} \text{ or } \frac{1}{729} \text{ or } 27^{-1}$$

$$\text{B1 for } 3 \text{ or } 729 \text{ or } \frac{1}{9^2} \text{ or } -27$$

B3

(b) $2^{3m} (= 2^{m^2})$ or $(2^3)^m (= 2^{m^2})$
oe

M1

$$m^2 = 3m \text{ or } m^2 - 3m = 0 \text{ or } m(m-3) = 0$$

$$\text{or } (m =) 0 \text{ or } (m =) 3$$

oe

0 and 3

A1

[6]

Q5.

 $\frac{1}{3}$ or 0.33...

$$B1 \ 3^{-1} \text{ or } \frac{\sqrt{1}}{3} \text{ or } \left(\frac{1}{9}\right)^{\frac{1}{2}} \text{ or } \sqrt{\frac{1}{9}}$$

$$\text{or } \frac{1}{9^{\frac{1}{2}}} \text{ or } \frac{1}{\sqrt{9}}$$

B2

Additional Guidance

For B1 responses $\frac{1}{2}$ can be 0.5For final two B1 responses 1 can be $\sqrt{1}$

[2]

Q6.

(a) m^3 *Do not accept $m \times m \times m$*

B1

(b) $3 \times 5 + 5 \times \sqrt{2} - 3 \times \sqrt{2} - \sqrt{2} \times \sqrt{2}$
 or $3 \times 5 + 2 \sqrt{2} - \sqrt{2} \sqrt{2}$
 or $13 + 5\sqrt{2} - 3\sqrt{2}$

*oe 4 terms or correct combination of 3 terms needed. If 4 terms given, 3 must be correct for M1**Allow in 'box method' or FOIL but watch out for correct signs (still allow one error).*

M1

$$13 + 2\sqrt{2}$$

A1

Additional Guidance

If answer correct allow 2 marks.

$$15 + 5\sqrt{2} - 3\sqrt{2} + 4$$

M1

$$19 + 2\sqrt{2}$$

A0

×	3	$\sqrt{2}$
5	15	$5\sqrt{2}$
$\sqrt{2}$	$3\sqrt{2}$	2

$$17 + 8\sqrt{2}$$

M0
(Only two terms correct)

×	3	$\sqrt{2}$
5	15	$5\sqrt{2}$
$-\sqrt{2}$	$3\sqrt{2}$	2

$$13 + 2\sqrt{2}$$

M1
A1
(Terms incorrect in table but 'recovered')

$$5 \times 3 = 15, 3 \times \sqrt{2} = 3\sqrt{2}, 5 \times \sqrt{2} = 5\sqrt{2}, -\sqrt{2} \times \sqrt{2} = -2$$

M1

$$13 + 8\sqrt{2}$$

A0

(c) $\frac{27}{5}$ or $5\frac{2}{5}$ or 5.4

B2 for 27 and $\frac{1}{5}$

B2 for $\frac{1}{5} \times 33$

B1 for 27 or $\frac{1}{5}$

B1 for 5 and 3 seen

Additional Guidance

$$\frac{1}{5} \times 33 = \frac{1}{5} \times 9 = 1.8$$

B2

$$\frac{1}{5} \times 9 = 1.8$$

B1

$\sqrt{25} = \pm 5$ and $\sqrt[4]{81} = \pm 3$ (allow a mixture of + and - for 3 and 5 but negative elsewhere not allowed)

B1

[6]

Q7.

$101.4^{\frac{1}{2}}$ estimated as 10
condone - 10

B1

(6.430 \Rightarrow) 1

B1

$7.99^{\frac{2}{3}}$ estimated as 4

B1

14

*condone -6 if -10 used
ft fully correct evaluation with B2 scored*

B1ft

[4]

Q8.

(a) 5

B1

(b) 1

B1

(c) $\sqrt[3]{27}$ or 3

M1

$\frac{1}{7^2}$ or $\left(\frac{1}{7}\right)^2$ or $\frac{1}{49}$

M1

$\frac{3}{49}$

A1

[5]

Q9.

2

B1

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

$\frac{2}{25}$ scores B1M1

M1

0.08

A1

[3]

Q10.

$$\frac{1}{3}$$

B1

[1]

Q11.

$$3x - (x - 5)$$

Condone omission of brackets

M1

$$2x + 5 = 17$$

M1

6

SC2 11

A1

Alternative 1

$$23x = 217 \times 2^x$$

M1

$$3x = 12 + x$$

M1

6

SC2 11

A1

Alternative 2

Substitutes a value for x and evaluates correctly as a power of 2.

M1

Substitutes a different value for x and evaluates correctly as a power of 2 which is closer to 17.

M1

6

SC2 11

A1

[3]

Q12.

$$x^{-\frac{2}{3}} \text{ or } a = -\frac{2}{3}$$

$$B2 (x^{\frac{1}{3}})^2 \text{ or } (x^2)^{\frac{-1}{3}} \text{ or } (x^{\frac{2}{3}})^{-1} \text{ or}$$

$$(x^{-2})^{\frac{1}{3}} \text{ or } (x^{\frac{1}{3}})^{-2} \text{ or } \frac{1}{x^{\frac{2}{3}}} \text{ or } -\frac{2}{3}$$

$$B1 (\sqrt[3]{x^3})^{-2} \text{ or } (\sqrt[3]{x^2})^{-1} \text{ or } (\frac{1}{x^2})^{\frac{1}{3}}$$

$$\text{or } \frac{1}{(x^2)^{\frac{1}{3}}} \text{ or } (\frac{1}{\sqrt[3]{x}})^2 \text{ or base } x \text{ with any negative index.}$$

B3

[3]