Topic 25 Indices and surds (Post-TT) [44] MARKSCHEME

1.

(a) $7 \times \frac{1}{9}$ M2

M1 for 7

M1 for $\frac{1}{9}$

$\frac{7}{9}$ A1

(b) 3^2 or $729^{\frac{1}{3}}$ M1

$\sqrt[3]{27} = 3$ *gets M1*

9 A1

[5]

2.

$(64^{\frac{1}{3}})^2$ $= 4^2 = 16$	**2** 2 AO2.2	**B1** for $(64^{\frac{1}{3}})^2$, 4^2 or $\sqrt[3]{4096}$ **oe**	Condone $(64^2)^{\frac{1}{3}}$ and $(4096)^{\frac{1}{3}}$ for **B1**

3.

Completes reasoning	M1	Expansion of $(4-\sqrt{3})(4+\sqrt{3})$ with at least 3 terms out of 4 correct or $4^2 - \sqrt{3} \times \sqrt{3}$
	C1	for $\sqrt{13}$ from correct working

4.

(a) 2^2 or $64^{\frac{1}{3}}$ or $3\sqrt{64}$ or $3\sqrt{8^2}$ M1

$= 4$ A1

(b) 4^{-1} or $\frac{1}{64^{\frac{1}{3}}}$ or $3\sqrt{\frac{1}{64}}$ B1

$= \frac{1}{4}$ B1

[4]

5.

(a) 9 B1

(b) $32 = 2^5$ B1

$\sqrt{32} = 2^{5/2}$ B1

(c) 4 B1

(d) $\frac{1}{(81)^{3/4}}$ B1

$= \frac{1}{27}$ B1

[6]

6. Multiply by $\frac{3+\sqrt{5}}{3+\sqrt{5}}$ [M1] soi

Denominator becomes 4 [B1]

Attempt to expand the numerator [M1] at least 2 terms correct

$6 + 2\sqrt{5} + 12\sqrt{5} + 4\sqrt{5}\sqrt{5}$ oe

$\frac{26+14\sqrt{5}}{4}$ [A1 for 26, A1 for $14\sqrt{5}$]

Simplifies to $\frac{13+7\sqrt{5}}{2}$ [A1]

7.

(a) 5 B1

(b) $162 = 2 \times 3^b$

$81 = 3^b$ M1

$b = 4$ A1

Hence $162 = 2 \times 3^4$

(c) $\frac{1}{32^{\frac{3}{5}}}$ B1

or B1 for $32^{\frac{3}{5}} = 8$ *or* 2^3

$= \frac{1}{8}$ B1

[5]

8.

(a)		138 ÷ 120 1.15	**M1** **A1** 1 AO1.3a 1 AO2.2		
(b)		558	**2** 2 AO1.3a	**M1** for 120×1.15^{11}	
(c)		Any correct reason	**1** 1 AO3.5		e.g. it may not continue to hold for that length of time e.g. the island may not be large enough for that number of birds e.g. there may not be enough food e.g. the original assumption may be wrong

9.

(a) $64^{-\frac{1}{2}} = \frac{1}{64^{\frac{1}{2}}}$ B1

Or 8^{-1}

$= \frac{1}{8}$ *oe* B1

(b) 2^5 B1

For $32 = 2^5$

$= 4^{\frac{5}{2}}$ B1

[4]

10.

<table>
<tr>
<td>(a)</td>
<td></td>
<td>4 440 000
or 4 441 000 to 4 441 100</td>
<td>2
2 AO1.3a</td>
<td>M1 for $30\,000 \times 2.3^6$</td>
<td>Allow 4 400 000 provided correct working seen</td>
</tr>
<tr>
<td>(b)</td>
<td></td>
<td>26 or 25.9[9]</td>
<td>3
1 AO1.3a
2 AO3.1a</td>
<td>M2 for $\left(\sqrt[3]{2}-1\right)\times 100$ oe

Or B1 for $\sqrt[3]{2}$ or 1.2599

Or M1 for $\left(\frac{100+k}{100}\right)^3 = 2$ oe</td>
<td><u>Alternative method using trial and improvement</u>

M2 for working towards calculating overall percentage increase over 3 years for both 25% and 26%
e.g. As a minimum:
$1.25^3 = 1.95[3\ ]$
and $1.26^3 = 2.000[\ ]$

Or M1 for working towards calculating a percentage increase over 3 years where k is between 20 and 30
e.g. $1.25^3 = 1.95[3\ ]$

Allow method marks for working in decimals, percentages or from their initial population

<table>
<tr><th><u>k</u></th><th>After 3 years</th></tr>
<tr><td>20</td><td>72.8</td></tr>
<tr><td>21</td><td>77.15</td></tr>
<tr><td>22</td><td>81.58</td></tr>
<tr><td>23</td><td>86.08</td></tr>
<tr><td>24</td><td>90.66</td></tr>
<tr><td>25</td><td>95.31</td></tr>
</table>
<table>
<tr><th>k</th><th>After 3 years</th></tr>
<tr><td>26</td><td>100.03</td></tr>
<tr><td>27</td><td>104.83</td></tr>
<tr><td>28</td><td>109.71</td></tr>
<tr><td>29</td><td>114.66</td></tr>
<tr><td>30</td><td>119.7</td></tr>
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