



4.2H Indices: Higher Tier Practice

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 Work out $3^2 * 3^{-1}$.

(Total for Question 1 is 1 mark)

2 Simplify $x^3 * x^{-5}$.

(Total for Question 2 is 2 marks)

3 Write 0.00072 in standard form ($a \times 10^n$ where $1 \leq a < 10$).

(Total for Question 3 is 2 marks)

4 Solve $2^x = 32$.

(Total for Question 4 is 2 marks)

5 Simplify $(x^2 y^{-3})^2 / (x^{-1} y)$. Give your answer with positive or negative powers as appropriate.

(Total for Question 5 is 3 marks)

6 Show that $2^n * 5^n = 10^n$ for any integer n .

(Total for Question 6 is 1 mark)

7 Evaluate $27^{2/3}$.

(Total for Question 7 is 2 marks)

8 Solve $4^{x-1} = 8$. Give your answer as a fraction or mixed number if needed.

(Total for Question 8 is 3 marks)

9 Show that $(x^3)^{1/2} * (x^2)^{1/3} = x^{13/6}$, stating any restriction on x if necessary.

(Total for Question 9 is 3 marks)

10 Simplify $(16x^4)^{3/2}$. Give your answer with integer coefficients and powers.

(Total for Question 10 is 3 marks)

11 Solve $(1/4) * 2^{3x} = 8$. Give your answer as a fraction.

(Total for Question 11 is 3 marks)

12 Simplify $(2x^{-1/3})^3 * (4x^{2/3})^2$. Give your answer simplified as a single term.

(Total for Question 12 is 3 marks)

13 Show that $x^{2/3} / x^{1/6} = x^{1/2}$. State any restriction on x.

(Total for Question 13 is 3 marks)

14 A culture contains 500 bacteria. The population doubles every 3 hours. Write an expression for the number of bacteria after t hours, then work out how many after 18 hours.

(Total for Question 14 is 3 marks)

Mark scheme · 4.2H Indices: Higher Tier Practice

Question 1

- **B1** 3 cao
- **Answer:**3
($3^2 * 3^{-1} = 3^{2-1} = 3^1 = 3$)

Question 2

- **M1** subtract exponents: $3 - 5 = -2$
- **A1** x^{-2} cao
- **Answer:** x^{-2}

Question 3

- **M1** move decimal point 4 places to the right to get 7.2
- **A1** 7.2×10^{-4} cao
- **Answer:** 7.2×10^{-4}

Question 4

- **M1** recognise $32 = 2^5$ or take logs
- **A1** $x = 5$ cao
- **Answer:** 5

Question 5

- **M1** apply power of a product: $(x^2 y^{-3})^2 = x^4 y^{-6}$
- **M1** divide by $x^{-1} y$ gives $x^{4-(-1)} y^{-6-1}$ or equivalent
- **A1** $x^5 y^{-7}$ cao
- **Answer:** $x^5 y^{-7}$

Question 6

- **C1** $2^n * 5^n = (2*5)^n = 10^n$ cso
- **Answer:** 10^n
(Because $2^n * 5^n = (2*5)^n = 10^n$.)

Question 7

- **M1** interpret $27^{2/3} = (\text{cube root of } 27)^2 \text{ or } (27^2)^{1/3}$
- **A1** 9 cao
- **Answer:**9
(since cube root of 27 is 3, $3^2 = 9$)

Question 8

- **M1** write 4 and 8 as powers of 2: $4^{x-1} = (2^2)^{x-1} = 2^{2x-2}$, $8 = 2^3$
- **M1** equate exponents: $2x - 2 = 3$
- **A1** $x = 5/2$ cao
- **Answer:** $5/2$

Question 9

- **M1** apply power rule: $(x^3)^{1/2} = x^{3/2}$ and $(x^2)^{1/3} = x^{2/3}$
- **M1** add exponents: $3/2 + 2/3 = (9+4)/6 = 13/6$
- **A1** $x^{13/6}$ cao; state $x \geq 0$ or work in real principal values
- **Answer:** $x^{13/6}$
(Valid for $x \geq 0$ if working with real principal fractional powers.)

Question 10

- **M1** use $(ab)^k = a^k b^k$ and $16^{3/2} = (16^{1/2})^3 = 4^3$
- **M1** $x^4 \cdot x^{3/2} = x^6$
- **A1** $64 x^6$ cao
- **Answer:** $64 x^6$

Question 11

- **M1** write $1/4$ as 2^{-2} ; $2^{3x} \cdot 2^{-2} = 2^3$
- **M1** combine exponents: $2^{3x-2} = 2^3$ so $3x - 2 = 3$
- **A1** $x = 5/3$ cao
- **Answer:** $5/3$

Question 12

- **M1** expand powers: $(2^3)(x^{-1/3} \cdot 3) = 8 x^{-1}$ and $(4^2)(x^{2/3 \cdot 2}) = 16 x^{4/3}$
- **M1** multiply coefficients $8 \cdot 16 = 128$ and add exponents $-1 + 4/3 = 1/3$
- **A1** $128 x^{1/3}$ cao
- **Answer:** $128 x^{1/3}$

Question 13

- **M1** subtract exponents: $2/3 - 1/6 = 4/6 - 1/6 = 3/6$
- **M1** $3/6$ simplifies to $1/2$
- **A1** $x^{1/2}$ cao; state $x > 0$ for real principal roots (division by $x^{1/6}$ requires $x \neq 0$)
- **Answer:** $x^{1/2}$
(Valid for $x > 0$ when interpreting fractional powers as principal real roots, since $x^{1/6}$ in the denominator cannot be zero.)

Question 14

- **M1** write expression $500 \cdot 2^{t/3}$ or $500 \cdot 2^{\lfloor t/3 \rfloor}$ Accept $500 \cdot 2^{t/3}$ as continuous model
- **M1** substitute $t = 18$: exponent $18/3 = 6$, so $500 \cdot 2^6$
- **A1** 32000 cao
- **Answer:** Number after t hours: $500 \cdot 2^{t/3}$.
Number after 18 hours: $500 \cdot 2^6 = 500 \cdot 64 = 32000$.