4.2 Indices: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

Index Laws Checklist

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Multiplying powers of the same base: add the indices, a^m * a^n = a^(m+n). Dividing powers of the same base: subtract the indices, a^m / a^n = a^(m-n). Raising a power to a power: multiply the indices, (a^m)^n = a^(m*n). Any non-zero number to the power 0 is 1: a^0 = 1. A negative index gives a reciprocal: a^-n = 1/a^n. A fractional index gives a root: a^(1/n) = nth root of a, and more generally a^(m/n) = (nth root of a)^m. Work through the fluency questions first to build speed with these rules, then use the exam-style questions to practise applying them in longer, marked problems.

1 Work out 2^3.

(Total for Question 1 is 1 mark)

2 Write down the value of 5^0.

(Total for Question 2 is 1 mark)

3 Write 2 x 2 x 2 x 2 as a power of 2.

(Total for Question 3 is 2 marks)

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4 Show that $(3^4 \times 3^{-2}) / 3 = 3$

(Total for Question 4 is 3 marks)

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5 Find the value of n.

$3^n = 3^4$

(Total for Question 5 is 2 marks)

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6 Simplify $a^3 \times 3a^4$

(Total for Question 6 is 2 marks)

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7 Solve each of the following equations.

(a) $6^x = 216$ **(1)**

(b) $7^{2x-1} = 343$ **(3)**

(Total for Question 7 is 4 marks)

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8 Evaluate $10^3 \div 10^2$ and write the answer as a power of 10.

(Total for Question 8 is 4 marks)

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9 Simplify and write the answer as a whole number: $2^4 \div 2^2$.

(Total for Question 9 is 4 marks)

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10 This question has two parts.

(a) Write 81 as a power of 3. **(3)**

(b) Evaluate $81 \div 3^2$ and give your answer as a whole number and as a power of 3. **(3)**

(Total for Question 10 is 6 marks)

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11 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 11 is 3 marks)

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12 The number 2^{12} is written in the form 4^{k}. Find the value of k.

(Total for Question 12 is 3 marks)

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

(Total for Question 13 is 3 marks)

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

(Total for Question 14 is 3 marks)

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15 Solve the equation $125^{x} = 25^{x+1} / 5$, giving your answer as an integer.

(Total for Question 15 is 4 marks)

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Mark scheme · 4.2 Indices: Test Pack

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

8 cao **B1**

Answer: 8

Question 2

1 cao **B1**

Answer: 1

Question 3

show grouping or state product as repeated multiplication, e.g. $2 \times 2 \times 2 \times 2 = 2^4$ **M1**

2^4 cao **A1**

Answer: 2^4

Question 4

$3^4 \times 3^{-2} = 3^2$ (or 9) seen **M1**

$3^2 / 3 = 3^1$ (dependent on first M1) **M1**

3 = 3 shown, cso (answer given, all steps correct) **A1**

Answer: 3 = 3 (shown)

Question 5

applies the index law or writes both sides as powers of the same base **M1**

n = 4 **A1**

Answer: n = 4

Question 6

correct coefficient **B1**

correct power(s) of the letter(s) **B1**

Answer: $3a^7$

Question 7

(a) x = 3 cao **B1**

(a) Answer: x = 3

(b) $343 = 7^3$ oe seen **M1**

(b) 2x - 1 = 3 oe **M1**

(b) x = 2 cao **A1**

(b) Answer: x = 2

Question 8

use law 10^{3-2} or show 1000 ÷ 100 **M1**

10^1 cao **A1**

or 10 cao **B1**

isw - ignore subsequent working once 10^1 or 10 given **E1**

Answer: 10^1 or 10

Question 9

use law 2^{4-2} or show 16 ÷ 4 **M1**

2^2 cao **A1**

4 cao **A1**

isw - ignore subsequent working once 4 given **E1**

Answer: 4

Question 10

(a) recognise repeated multiplication or use known powers of 3 **M1**

(a) 3^4 cao **A1**

(a) or 81 cao **B1**

(a) Answer: 3^4 or 81

(b) use law $3^4 \div 3^2 = 3^{4-2}$ or compute 81 ÷ 9 **M1**

(b) 3^2 cao **A1**

(b) 9 cao **A1**

(b) Answer: $3^2 = 9$

Question 11

write expression $500 * 2^{t/3}$ or $500 * 2^{floor?}$ Accept $500 * 2^{t/3}$ as continuous model **M1**

substitute t = 18: exponent 18/3 = 6, so $500 * 2^6$ **M1**

32000 cao **A1**

Answer:Number after t hours: $500 * 2^{t/3}$.
Number after 18 hours: $500 * 2^6 = 500 * 64 = 32000$.

Question 12

$4^k = 2^{2k}$ oe seen (or $4 = 2^2$ identified) **M1**

2k = 12 oe **M1**

k = 6 cao **A1**

Answer: k = 6

Question 13

write 1/4 as 2^{-2}: $2^{3x} * 2^{-2} = 2^3$ **M1**

combine exponents: $2^{3x-2} = 2^3$ so 3x - 2 = 3 **M1**

x = 5/3 cao **A1**

Answer: 5/3

Question 14

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 **M1**

$x^{13/6}$ cao; state $x \geq 0$ or work in real principal values **A1**

Answer:$x^{13/6}$
(Valid for $x \geq 0$ if working with real principal fractional powers.)

Question 15

$125^x = 5^{3x}$ oe seen **M1**

$25^{x+1} / 5 = 5^{2x+1}$ oe seen **M1**

dependent, 3x = 2x + 1 oe (equating indices) **M1**

x = 1 cao **A1**

Answer: x = 1

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