4.3 Prime Factors, HCF and LCM: 30-minute Pack

EDEXCEL 1MA1 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

Prime Factors, HCF and LCM: Fluency and Exam Drill

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This drill pack builds fluency in writing numbers as a product of their prime factors, and in using prime factorisation to find the highest common factor (HCF) and lowest common multiple (LCM) of two or more numbers. It then moves into exam-style problem-solving questions, including reasoning questions that ask you to explain or show your answer. This pack complements the main Topic 4.3 practice pack and does not share any questions with it. Show all of your working - method marks are available even when a final answer is wrong. Calculators are not allowed for this pack.

1 Write down the two prime numbers that multiply together to make 35.

(Total for Question 1 is 1 mark)

2 Work out the highest common factor (HCF) of 18 and 24.

(Total for Question 2 is 1 mark)

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3 Work out both the HCF and the LCM of 12 and 30. Show your working.

(a) Find the HCF of 12 and 30. **(2)**

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(b) Find the LCM of 12 and 30. **(2)**

.....

(Total for Question 3 is 4 marks)

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4 Find the highest common factor (HCF) and the lowest common multiple (LCM) of 69 and 92.

(Total for Question 4 is 3 marks)

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5 Two lights both flash at 08:15. One flashes every 19 minutes and the other every 38 minutes. At what time will they next flash together?

(Total for Question 5 is 3 marks)

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6 Write 84 as a product of its prime factors, giving your answer in index form.

(Total for Question 6 is 2 marks)

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7 Find the HCF and the LCM of 8, 12 and 20. Show your method.

(a) Find the HCF of 8, 12 and 20. **(2)**

(b) Find the LCM of 8, 12 and 20. **(2)**

(Total for Question 7 is 4 marks)

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8 Show that for any two positive integers a and b with prime factorisations a = product $p_i^{\alpha_i}$ and b = product $p_i^{\beta_i}$ (over the same primes p_i), the product a x b equals HCF(a, b) x LCM(a, b). You must give a reason referring to prime exponents. This is a 'show that' question.

(Total for Question 8 is 4 marks)

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9 Find the smallest positive integer n such that n is a multiple of both 18 and 24, and n is also a perfect square.

(Total for Question 9 is 4 marks)

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Mark scheme · 4.3 Prime Factors, HCF and LCM: 30-minute Pack

Question 1

5 and 7 cao **B1**

Answer: 5 and 7

Question 2

6 cao **B1**

Answer: 6

Question 3

(a) method shown, e.g. prime factors $12 = 2^2 * 3$ and $30 = 2 * 3 * 5$ **M1**

(a) 6 cao **A1**

(a) Answer: 6

(b) method shown, e.g. take highest powers 2^2, 3, 5 or list multiples **M1**

(b) 60 cao **A1**

(b) Answer: 60

Question 4

prime factorisations or lists of factors/multiples **M1**

HCF = 23 **A1**

LCM = 276 **A1**

Answer: HCF = 23, LCM = 276

Question 5

uses multiples or the LCM method **M1**

LCM = 38 **A1**

08:53 **B1**

Answer: 08:53

Question 6

at least two correct prime factors identified, e.g. 2, 2, 3, 7 from a factor tree or repeated division **M1**

2^2 x 3 x 7 oe, fully correct in index form **A1**

Answer: 2^2 x 3 x 7

Question 7

(a) method shown, e.g. prime factors $8=2^3$, $12=2^2*3$, $20=2^2*5$ and take common powers **M1**

(a) 4 cao **A1**

(a) Answer: 4

(b) method shown, take highest powers 2^3, 3, and 5 **M1**

(b) 120 cao **A1**

(b) Answer: 120

Question 8

express HCF exponents as $\min(\alpha_i, \beta_i)$ and LCM exponents as $\max(\alpha_i, \beta_i)$ **M1**

note that for each i, $\alpha_i + \beta_i = \min(\alpha_i,\beta_i) + \max(\alpha_i,\beta_i)$ **M1**

multiply over all primes to get a x b = product $p_i^{\alpha_i+\beta_i}$ = product $p_i^{\min+\max}$ = HCF x LCM (method) **M1**

clear conclusion: therefore a x b = HCF(a,b) x LCM(a,b) cso **A1**

Answer: For each prime p_i, exponent in HCF = $\min(\alpha_i,\beta_i)$, exponent in LCM = $\max(\alpha_i,\beta_i)$. $\alpha_i + \beta_i$ = min + max, so multiplying $p_i^{\alpha_i} p_i^{\beta_i} = p_i^{\min} p_i^{\max}$. Product over all primes gives a x b = HCF x LCM. Hence shown.

Question 9

$18 = 2 \times 3^2$ and $24 = 2^3 \times 3$ used to find LCM(18,24) = $2^3 \times 3^2 = 72$ **M1**

recognising that for n to be a perfect square, every prime in its factorisation must have an even power **M1**

identifying that the power of 2 (currently 2^3) is the only odd power, so 72 must be multiplied by a further 2 **M1**

144 cao **A1**

Answer: 144

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