

# WA1 Practice Paper

Prime factorisation, real numbers, estimation and approximation

25 marks | Suggested time: 40 minutes

Name: ..... Class: ..... Date: .....

Answer all questions. Show your working. A scientific calculator may be used. Give non-exact answers to 3 significant figures unless stated otherwise.

School WA topic coverage may differ. The suggested solutions start after the question paper.

## 1. Number classification [3 marks]

From the following list, write down:

$$0.6, -3, \pi + 2, \sqrt{2}, \frac{29}{3}, 11$$

(a) An integer. [1]

Answer: ..... [1]

(b) A prime number. [1]

Answer: ..... [1]

(c) An irrational number. [1]

Answer: ..... [1]

## 2. Number line [2 marks]

Represent these numbers on the number line. Label each point with its original expression.

$$0.5, -\sqrt[3]{8}, 4, (-1)^2$$



All four points must be labelled. [2]

**3. Real-number calculation [1 marks]**

Calculate:

$$\frac{-\sqrt{81} + (-2)^2 \times 9}{2^3}$$

Answer: ..... [1]

**4. Prime factorisation and HCF [2 marks]**

It is given that:

$$1323 = 3^3 \times 7^2$$

(a) Express 440 as a product of its prime factors. [1]

Answer: ..... [1]

(b) Find the highest common factor of 440 and 1323. [1]

Answer: ..... [1]

**5. Prime factors and perfect cubes [5 marks]**

(a) Express 360 as a product of its prime factors. [1]

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Answer: ..... [1]

(b) The expression below is a perfect cube. Both p and q are prime numbers. Find p and q. [2]

$$\frac{360p}{q}$$

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Answer: ..... [2]

(c) x is an integer between 100 and 200. The highest common factor of x and 360 is 30. Find the smallest possible value of x. [2]

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Answer: ..... [2]

**6. Integers, HCF and LCM [6 marks]**

Three positive integers  $a$ ,  $b$  and  $c$  satisfy  $a > b > c$ . Their sum is 30 and  $b = 6$ .

(a)(i) Find the greatest value of  $a$  if  $a$  is prime. [2]

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Answer: ..... [2]

(a)(ii) Find the smallest possible value of  $a$ . [1]

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Answer: ..... [1]

(b) Two positive integers  $x$  and  $y$  have HCF 42 and LCM 1512. Both are less than 1000. Find  $x$  and  $y$ . [3]

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Answer: ..... [3]

**7. Approximation [2 marks]**

Using your calculator, evaluate:

$$\frac{\sqrt[3]{92.3}}{3.52^2 - 1.42}$$

(a) Give your answer to 3 significant figures. [1]

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Answer: ..... [1]

(b) Give your answer to 1 decimal place. [1]

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Answer: ..... [1]

**8. Estimation [4 marks]**

A rectangular container measures 17.3 cm by 9.6 cm by 34.8 cm.

(a) Round each dimension to 1 significant figure, then estimate the volume. [2]

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Answer: ..... [2]

(b) A cubical container has the same estimated volume. Calculate the length of one side. [2]

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Answer: ..... [2]

**End of question paper**

# WA1 Suggested Worked Solutions

Use these solutions after attempting the paper. Other mathematically valid methods may be accepted. The mark allocations are suggestions for this practice paper, not an official school marking scheme.

## 1. Number classification [3]

- (a)  $-3$  or  $11$ . An integer has no fractional part.  
 (b)  $11$ . A prime number has exactly two positive factors.  
 (c)  $\pi + 2$  or  $\sqrt{2}$ . Neither can be expressed as a ratio of integers.

Suggested marking: 1 mark for each correct selection.

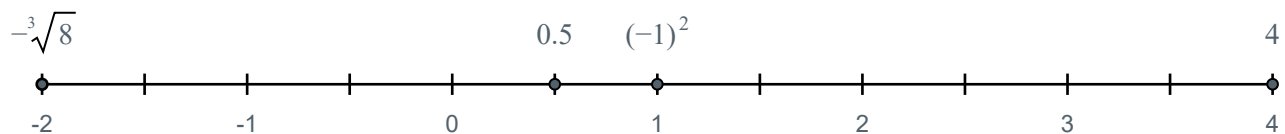
Watch out: A negative integer is not classified as a prime number.

## 2. Number line [2]

$$-\sqrt[3]{8} = -2$$

$$(-1)^2 = 1$$

Place and label the four values:



Suggested marking:  $\frac{1}{2}$  mark per correctly positioned and labelled point.

Watch out: The minus sign is outside the cube root; the brackets in  $(-1)^2$  mean the whole negative number is squared.

## 3. Real-number calculation [1]

$$\frac{-\sqrt{81} + (-2)^2 \times 9}{2^3} = \frac{-9 + 4 \times 9}{8}$$

$$= \frac{27}{8} = 3.375$$

Suggested marking: 1 mark for the exact answer.

Watch out: Evaluate roots and powers first, then multiplication, then addition.

**4. Prime factorisation and HCF [2]**

(a) Divide 440 into prime factors:

$$440 = 2 \times 220 = 2 \times 2 \times 110 = 2 \times 2 \times 2 \times 55$$

$$440 = 2^3 \times 5 \times 11$$

(b) 1323 has only the prime factors 3 and 7. The numbers share no prime factors, so HCF = 1.

Suggested marking: 1 mark for each part.

Watch out: 1 is a common factor even when there are no shared prime factors.

**5. Prime factors and perfect cubes [5]**

(a)

$$360 = 36 \times 10 = 2^3 \times 3^2 \times 5$$

(b) In a perfect cube, every prime-factor exponent is a multiple of 3. Multiply by 3 to raise the exponent of 3, and divide by 5 to remove the unpaired factor.

$$\frac{360 \times 3}{5} = 2^3 \times 3^3 = 6^3 = 216$$

p = 3 and q = 5.

(c) x must be a multiple of 30. Between 100 and 200, the candidates are 120, 150 and 180.

$$\text{HCF}(120, 360) = 120$$

$$\text{HCF}(150, 360) = 30$$

$$\text{HCF}(180, 360) = 180$$

Therefore the smallest valid value is x = 150.

Suggested marking: (a) 1; (b) 1 for each prime; (c) 1 for a valid method and 1 for the answer.

## 6. Integers, HCF and LCM [6]

(a) Since  $a + 6 + c = 30$ ,  $a + c = 24$ . Also  $1 \leq c \leq 5$ , giving  $19 \leq a \leq 23$ .

(i) The greatest prime in this interval is 23, with  $c = 1$ .

(ii) The smallest  $a$  is 19, with  $c = 5$ .

(b) Write  $x = 42u$  and  $y = 42v$ . The integers  $u$  and  $v$  must be coprime; otherwise the HCF would exceed 42.

$$42uv = 1512, \text{ so } uv = \frac{1512}{42} = 36$$

Factor pairs of 36 are (1,36), (2,18), (3,12), (4,9) and (6,6). Only (1,36) and (4,9) are coprime.

(1,36) gives 42 and 1512, violating the upper limit.

(4,9) gives  $x = 168$  and  $y = 378$ , in either order.

$$\text{HCF}(168, 378) = 42; \text{LCM}(168, 378) = 1512$$

Suggested marking: (a)(i) 2; (a)(ii) 1; (b) 1 for reducing to  $uv = 36$ , 1 for selecting (4,9), 1 for both integers.

## 7. Approximation [2]

$$\frac{\sqrt[3]{92.3}}{3.52^2 - 1.42} = 0.411950250\dots$$

(a) 0.412 to 3 significant figures.

(b) 0.4 to 1 decimal place.

Suggested marking: 1 mark for each rounded answer.

Watch out: Enter the whole denominator in brackets. Round the final answer, not intermediate values.

## 8. Estimation [4]

(a) To 1 significant figure:  $17.3 \rightarrow 20$ ;  $9.6 \rightarrow 10$ ;  $34.8 \rightarrow 30$ .

$$\text{Estimated volume} = 20 \times 10 \times 30 = 6000 \text{ cm}^3$$

(b) If the cube side is  $s$  cm,  $s^3 = 6000$ .

$$s = \sqrt[3]{6000} = 18.1712059\dots$$

Side length = 18.2 cm to 3 significant figures.

Suggested marking: (a) 1 for rounding, 1 for volume; (b) 1 for the cube root, 1 for the rounded answer.

Watch out: Use the estimated volume from part (a), as requested.