# TEST 2 Factors and Multiples

**Marks: /60**

**Time: 1 hour 30 minutes**

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

## INSTRUCTIONS TO CANDIDATES

**Section A (30 marks)** **Time: 45 minutes**

1. Answer **all** the questions in this section.
2. Calculators may **not** be used in this section.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [ ] at the end of each question.

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**1** **(a)** Find the HCF of 36, 90 and 108.
**(b)** Find the LCM of 45, 60 and 150.

*Answer (a)* ..... [1]

*(b)* ..... [1]

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**2** **(a)** Find the sum of the largest and smallest prime numbers that lie between 29 and 83.
**(b)** Write down the largest prime factor of 1368.

*Answer (a)* ..... [1]

*(b)* ..... [1]

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3 Given that $m$ lies between 17 and 23, find
**(a)** $m$ if $m$ is a prime number,
**(b)** $m$ such that $m$ and 49 have a common prime factor.

*Answer (a)* $m =$ ..... [1]

*(b)* $m =$ ..... [1]

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4 **(a)** Find the LCM of $2^2 \times 3 \times 5$, $2^2 \times 5 \times 7$ and $2 \times 3^2 \times 5^3 \times 11$. Give your answer in index notation.
**(b)** Express 38 as a sum of two different prime numbers.

*Answer (a)* ..... [2]

*(b)* ..... [1]

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5 **(a)** Express 9261 as a product of prime factors and hence find the cube root of 9261.
**(b)** Find the largest multiple of 7 that is less than $3^3 + 5^2 \times \sqrt[3]{64}$.

*Answer (a)* 9261 = .....

$\sqrt[3]{9261}$ = ..... [2]

*(b)* ..... [2]

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6 **(a)** Find the product of the HCF and LCM of 24, 45 and 75.
**(b)** The lowest common multiple of 10, 15 and $p$ is 150. Find the two possible values of $p$ which are odd numbers.

*Answer (a)* ..... [2]

*(b)* $p =$ ..... [2]

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7 **(a)** Find the missing digit in 1283__5 if 1283__5 is divisible by 9.
**(b)** Find the missing digit in 2681__61 if 2681__61 is divisible by 11.

*Answer (a)* ..... [2]

*(b)* ..... [2]

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8 The numbers 60 and 576, written as the product of their prime factors are

$$60 = 2^2 \times 3 \times 5 \quad \text{and} \quad 576 = 2^6 \times 3^2.$$

Find

(a) $\sqrt{576}$,
(b) the largest integer which is a factor of both 60 and 576,
(c) the smallest positive integer value of $x$ for which $60x$ is a multiple of 576.

*Answer (a)* ..... [1]

*(b)* ..... [1]

*(c)* $x =$ ..... [1]

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**9** (a) Given that $2^6 \times 11^2 = 7744$, evaluate $\sqrt{7744}$.

(b) Write 1728 as a product of prime factors. Hence find the value of $\sqrt[3]{1728}$.

*Answer (a)* ..... [1]

*(b)* 1728 = .....

$\sqrt[3]{1728}$ = ..... [2]

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**10** (a) Write down the first prime number greater than 80 and the largest prime number smaller than 150.

(b) Find the sum of the first five prime numbers ending with the digit 3.

*Answer (a)* ..... , ..... [1]

*(b)* ..... [2]

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## INSTRUCTIONS TO CANDIDATES

**Section B (30 marks)** **Time: 45 minutes**

1. Answer **all** the questions in this section.
2. Calculators may be used in this section.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [ ] at the end of each question.

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**11** **(a)** Evaluate $\dfrac{5^3 \times \sqrt[3]{6859} + \sqrt{5625}}{\sqrt{11\,236} - 2^3}$.

**(b)** Find the sum of all the prime numbers between 70 and 100.

**(c)** The HCF of 56, $x$ and 154 is 14 and their LCM is 4312. Find the smallest possible value of $x$.

*Answer (a)* ..... [1]

*(b)* ..... [2]

*(c)* $x =$ ..... [3]

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**12** **(a)** Two numbers are greater than 15 and smaller than 25. Given that their HCF and LCM are 1 and 391 respectively, find the two numbers.

**(b)** Bus Service *A* leaves the Yishun Interchange every 3 minutes. Bus Service *B* leaves the Yishun Interchange every 6 minutes and Bus Service *C* leaves the Yishun Interchange every 4 minutes. If all the three bus services first leave the bus interchange at 06 00, when would the last time the three buses leave the interchange together before 06 30?

*Answer (a)* ..... , ..... [2]

*(b)* ..... [4]

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**13** Mrs Goh has three pieces of ribbons measuring 120 cm, 192 cm and 252 cm respectively. She wants to cut the ribbons into smaller pieces of equal lengths with no remainders.

**(a)** Find the greatest possible length of each of the smaller pieces of ribbons.

**(b)** How many of the smaller pieces of ribbons of equal length can she get?

*Answer (a)* ..... cm [4]

*(b)* ..... [1]

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**14** During the children's day celebration, a school distributed 825 files, 495 pens and 660 bookmarks equally to the students of the school.

**(a)** Find the largest possible number of students in the school that day.

**(b)** Find the largest number of files, pens and bookmarks received by each student.

*Answer (a)* ..... students [3]

*(b)* ..... files

..... pens

..... bookmarks [2]

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**15** (a) Three toy racing cars go round a circular track in 1 minute, 1 minute 20 seconds and 2 minutes 20 seconds respectively. If they begin at the same starting point, how many minutes would have elapsed before they are side by side again?

(b) The floor of a showroom measures 540 cm by 740 cm.

(i) Find the area of the largest square tile that can be used to tile the floor without cutting any of the square tiles.

(ii) Calculate the total number of these square tiles required to completely cover the floor.

*Answer (a)* ..... min [4]

*(b)* (i) ..... $cm^2$ [3]

(ii) ..... tiles [1]

**Teacher's Tip**

**Quotient**: The result of dividing one quantity by another.
**Division**: The number by which we are dividing.
**Dividend**: A number which is being divided.

E.g. quotient
↑
2 R 1 ← remainder
divisor → 5 ) 11 ← dividend
10
1

## Test 2: Factors and Multiples

### Section A

1. (a) **Method 1:** Using prime factors

$36 = 2 \times 2 \times 3 \times 3$
$90 = 2 \times 3 \times 3 \times 5$
$108 = 2 \times 2 \times 3 \times 3 \times 3$

HCF $= 2 \times 3 \times 3 = \mathbf{18}$

| 2 \| 36 |
|---|
| 2 \| 18 |
| 3 \| 9 |
| 3 \| 3 |
| 1 |

| 2 \| 90 |
|---|
| 3 \| 45 |
| 3 \| 15 |
| 5 \| 5 |
| 1 |

| 2 \| 108 |
|---|
| 2 \| 54 |
| 3 \| 27 |
| 3 \| 9 |
| 3 \| 3 |
| 1 |

**Teacher's Tip**

The HCF is the product of the common factors.

**Method 2:** Using prime division

| 2 \| 36, 90, 108 |
|---|
| 3 \| 18, 45, 54 |
| 3 \| 6, 15, 18 |
| 2, 5, 6 |

**Teacher's Tip**

Divide by the smallest common factor of the 3 numbers until there are no more common factors.

$\therefore$ HCF $= 2 \times 3 \times 3 = \mathbf{18}$

**Teacher's Tip**

When a set of numbers has more than one common factor, the largest of these common factors is the HCF. (Highest common factor)

(b) **Method 1:** Using prime factors

$45 = 3^2 \times 5$
$60 = 2^2 \times 3 \times 5$
$150 = 2 \times 3 \times 5^2$
$\therefore$ LCM $= 2^2 \times 3^2 \times 5^2$
$= \mathbf{900}$

**Teacher's Tip**

The LCM is the product of the different factors with the highest power.

**Method 2:** Using prime division

| 2 \| 45, 60, 150 |
|---|
| 2 \| 45, 30, 75 |
| 3 \| 45, 15, 75 |
| 3 \| 15, 5, 25 |
| 5 \| 5, 5, 25 |
| 5 \| 1, 1, 5 |
| 1, 1, 1 |

**Teacher's Tip**

Divide by the smallest factor. If a number is not divisible, carry it down to the next line as it is. Continue to divide until all the quotients are 1.

$\therefore$ the LCM $= 2^2 \times 3^2 \times 5^2 = \mathbf{900}$.

**Teacher's Tip**

When a set of numbers has many common multiples, the smallest of these is the LCM. (Lowest common multiple)

2. (a)

**Teacher's Tip**

A prime number is a number which is divisible by itself and 1.

Largest prime number = 79
Smallest prime number = 31
Sum of 31 and 79
$= 31 + 79$
$= \mathbf{110}$

(b)

**Teacher's Tip**

Express 1368 as a product of prime factors first.

$1368 = 2^3 \times 3^2 \times 19$
$\therefore$ largest prime factor = **19**

| 2 \| 1368 |
|---|
| 2 \| 684 |
| 2 \| 342 |
| 3 \| 171 |
| 3 \| 57 |
| 19 \| 19 |
| 1 |

3. (a) $m = \mathbf{19}$

(b) $49 = 7 \times 7$
$21 = 3 \times 7$
$\therefore m = \mathbf{21}$

**Teacher's Tip**
The possible values of $m$: 18, 19, 20, 21
Since $m$ and 49 have a common factor, i.e. 7, $m$ is 21.

4. (a) $2^2 \times 3 \times 5$
$2^2 \times 7$
$2 \times 3^2 \times 5^3 \times 11$
LCM $= \mathbf{2^2 \times 3^2 \times 5^3 \times 7 \times 11}$

(b) Prime numbers < 38 = 2, 3, 5, **7**, 11, 13, 17, 19, 23, 29, **31**, 37
$\therefore 38 = \mathbf{7 + 31}$

5. (a)

**Teacher's Tip**
Express 9261 as a product of prime factors first.

| | |
|---|---|
| 3 | 9261 |
| 3 | 3087 |
| 3 | 1029 |
| 7 | 343 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

$\therefore 9261 = \mathbf{3 \times 3 \times 3 \times 7 \times 7 \times 7}$
$\sqrt[3]{9261} = \sqrt[3]{3 \times 3 \times 3 \times 7 \times 7 \times 7}$
$= \sqrt[3]{(3 \times 7)^3}$
$= 3 \times 7$
$= \mathbf{21}$

(b) $3^3 + 5^2 \times \sqrt[3]{64}$
$= 27 + \underbrace{25 \times 4}$
$= 27 + 100$
$= 127$
$\therefore$ the largest multiple of 7 which is smaller than 127 is **126**, i.e $18 \times 7$.

6. (a) $24 = 2^3 \times 3$
$45 = 3^2 \times 5$
$75 = 3 \times 5^2$

HCF = 3
LCM $= 2^3 \times 3^2 \times 5^2 = 1800$
Product of 3 and 1800
$= 3 \times 1800$
$= \mathbf{5400}$

(b) $10 = 2 \times 5$
$15 = 3 \times 5$
$150 = 2 \times 3 \times 5^2$
The possible values of $p$ which are odd are:
$p = 5^2 = \mathbf{25}$
$p = 3 \times 5^2 = \mathbf{75}$

7. (a) 128385 is divisible by 9 since $1 + 2 + 8 + 3 + \mathbf{8} + 5 = 27$ is divisible by 9.
$\therefore$ the missing digit is **8**.

**Teacher's Tip**
A number is divisible by 9 if the sum of its digits is divisible by 9.

(b) 2681261 is divisible by 11 as
$(2 + 8 + \mathbf{2} + 1) - (6 + 1 + 6) = 0$
$\therefore$ the missing digit is **2**.

**Teacher's Tip**
A number is divisible by 11 if
(sum of the digits in the odd places) − (sum of the digits in the even places) = 0 or a multiple of 11

8. (a) $576 = 2^6 \times 3^2$ (Given)
$\sqrt{576} = \sqrt{2^6 \times 3^2}$
$= \sqrt{(2 \times 2 \times 2 \times 3)^2}$
$= 2 \times 2 \times 2 \times 3$
$= \mathbf{24}$

(b) $60 = 2^2 \times 3 \times 5$
$576 = 2^6 \times 3^2$
HCF $= 2^2 \times 3 = \mathbf{12}$

**Teacher's Tip**
The largest integer which is a factor of both 60 and 576 is the HCF of both numbers.

(c) $60 = 2^2 \times 3 \times 5$
$576 = 2^6 \times 3^2$
LCM $= 2^6 \times 3^2 \times 5$
$x = \dfrac{2^6 \times 3^2 \times 5}{60}$
$= \dfrac{2^6 \times 3^2 \times 5}{2^2 \times 3 \times 5}$
$= 2^4 \times 3$
$= \mathbf{48}$

Find the LCM of 60 and 576.

9. (a) $2^6 \times 11^2 = 7744$ (Given)
$\sqrt{7744} = \sqrt{2^6 \times 11^2}$
$= \sqrt{(2 \times 2 \times 2 \times 11)^2}$
$= 2 \times 2 \times 2 \times 11$
$= \mathbf{88}$

(b)

| | |
|---|---|
| 2 | 1728 |
| 2 | 864 |
| 2 | 432 |
| 2 | 216 |
| 2 | 108 |
| 2 | 54 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

$\therefore 1728 = 2^6 \times 3^3$

$\sqrt[3]{1728} = \sqrt[3]{2^6 \times 3^3}$

$= \sqrt[3]{(2 \times 2 \times 3)^3}$

$= 2 \times 2 \times 3$

$= \mathbf{12}$

10. (a) **83** and **149**

(b) $3 + 13 + 23 + 43 + 53 = \mathbf{135}$

## Section B

11. (a) $\dfrac{5^3 \times \sqrt[3]{6859} \times \sqrt{5625}}{\sqrt{11\,236} - 2^3}$

Use a calculator to evaluate the answer.

$= \mathbf{25}$

(b) $71 + 73 + 79 + 83 + 89 + 97 = \mathbf{492}$

(c) $56 = 2^3 \times 7$

$154 = 2 \times 7 \times 11$

HCF $= 14 = 2 \times 7$ (Given)

LCM $= 4312 = 2^3 \times 7^2 \times 11$ (Given)

$\therefore$ smallest possible value of $x = 2 \times 7^2 = \mathbf{98}$.

12. (a)

**Teacher's Tip**

Express 391 as a product of prime factors.

$391 = 17 \times 23$

Since the HCF and LCM are 1 and 391, the 2 numbers are **17** and **23.**

(b)

**Teacher's Tip**

Find the LCM of 3, 6 and 4. Then find the biggest multiple of the LCM which is smaller than 30. (06 30 − 06 00 = 00 30)

| | |
|---|---|
| 2 | 3, 6, 4 |
| 2 | 3, 3, 2 |
| 3 | 3, 3, 1 |
| | 1, 1, 1 |

$\therefore$ LCM $= 2^2 \times 3 = 12$

**Teacher's Tip**

The 3 buses will leave the interchange together after every 12 minutes, starting from 06 12.

$\therefore$ the last time the 3 buses leave the interchange together before 06 30 is at **06 24.**

13. (a)

**Teacher's Tip**

The greatest possible length is the HCF of the lengths of the 3 ribbons.

$120 = 2^3 \times 3 \times 5$

$192 = 2^6 \times 3$

$252 = 2^2 \times 3^2 \times 7$

$\therefore$ HCF $= 2^2 \times 3 = 12$

The greatest possible length of each of the smaller pieces of ribbon is **12 cm.**

(b) $(120 + 192 + 252) \div 12 = 47$

She can get **47** smaller pieces of ribbons of equal length.

14. (a)

**Teacher's Tip**

To calculate the largest possible number of students, find the HCF of 825, 495 and 660.

$825 = 3 \times 5^2 \times 11$

$495 = 3^2 \times 5 \times 11$

$660 = 2^2 \times 3 \times 5 \times 11$

$\therefore$ HCF $= 3 \times 5 \times 11 = 165$

$\therefore$ the largest possible number of students in the school that day is **165.**

(b) No. of files $= 825 \div 165 = \mathbf{5}$

No. of pens $= 495 \div 165 = \mathbf{3}$

No. of bookmarks $= 660 \div 165 = \mathbf{4}$

15. (a)

**Teacher's Tip**

To calculate the time that would have elapsed before the 3 cars are side by side again, find the LCM of 1 min, 1 min 20 s and 2 min 20 s.

1 min = 60 s

1 min 20 s = 80 s

2 min 20 s = 140 s

$60 = 2^2 \times 3 \times 5$

$80 = 2^4 \times 5$

$140 = 2^2 \times 5 \times 7$

LCM $= 2^4 \times 3 \times 5 \times 7 = 1680$

$1680 \text{ s} = \dfrac{1680}{60} \text{ min}$

$= 28 \text{ min}$

$\therefore$ **28 minutes** would elapse before the 3 cars are side by side again.

(b) (i)

**Teacher's Tip**

The HCF of 540 and 740 gives the length of each side of the largest square tile.

$540 = 2^2 \times 3^3 \times 5$
$740 = 2^2 \quad \times 5 \times 37$
$\therefore$ HCF $= 2^2 \times 5 = 20$
Area of largest square tile
$= 20 \times 20$
$= \mathbf{400\ cm^2}$

(ii) Total no. of square tiles required
$= (540 \times 740) \div 400$
$= \mathbf{999}$

## Test 3: Number Sequences and Problem Solving

### Section A

1. (a) 1, 2, 4, 7, 11, ___, ___, ....
+1 +2 +3 +4
$\therefore$ the next 2 terms are $11 + 5 = \mathbf{16}$
and $16 + 6 = \mathbf{22}$.

**Teacher's Tip**

The difference between consecutive terms increases by 1 each time.

(b)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5, | 16, | 33, | 56, | 85, | 120, | 161, | ... |
| 1st difference | | 11 | 17 | 23 | 29 | 35 | 41 | |
| 2nd difference | | | 6 | 6 | 6 | 6 | 6 | |

$\therefore$ the next 2 terms in the 1st difference are
$29 + 6 = 35$ and
$35 + 6 = 41$.

$\therefore$ the next 2 terms of the sequence are
$85 + 35 = \mathbf{120}$ and
$120 + 41 = \mathbf{161}$.

2. (a)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1, | 5, | 19, | 43, | $x$, | $y$, | 175, | ... |
| 1st difference | | 4 | 14 | 24 | 34 | 44 | 54 | |
| 2nd difference | | | 10 | 10 | 10 | 10 | 10 | |

$\therefore \quad x = 43 + 34 = 77$
$y = 77 + 44 = 121$
$x + y = 77 + 121 = \mathbf{198}$

(b) 1, 2, 4, 8, $x$, 32, $y$, 128, ...
$x = 2 \times 8 \qquad y = 2 \times 32$
$\quad = 16 \qquad\quad = 64$
$x + y = 16 + 64$
$= \mathbf{80}$

**Teacher's Tip**

Double the term before to get to the next term.

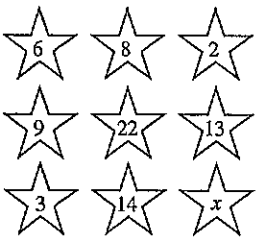
3.

**Teacher's Tip**

The first 5 toothpicks makes 2 triangles. Subsequently every batch of 2 toothpicks give an additional triangle.

Since $55 = 5 + 25 \times 2$, there are
$2 + 25 = \mathbf{27\ triangles}$.

4. (a)




$x = 14 - 3 = \mathbf{11}$

**Teacher's Tip**

The number in the third star is the difference between the numbers in the first two stars of each row.

(b)

| | | | |
|---|---|---|---|
| 7 | 12 | 1 | 14 |
| 2 | 13 | 8 | 11 |
| 16 | 3 | 10 | 5 |
| 9 | 6 | 15 | 4 |

**Teacher's Tip**

The sum of the numbers across, down and diagonally is always the same, i.e. 34.

5. (a) $\mathbf{5 \times 5 = 4 \times 6 + 1}$
(b) $\mathbf{100 \times 100 = 99 \times 101 + 1}$
(c) $a \times a = 17 \times 19 + 1$
$\therefore a = 17 + 1 = \mathbf{18}$

6. 1st term: $5 = 5 \times 1 = 5 \times 1^2$
2nd term: $20 = 5 \times 4 = 5 \times 2^2$
3rd term: $45 = 5 \times 9 = 5 \times 3^2$
4th term: $80 = 5 \times 16 = 5 \times 4^2$
5th term: $125 = 5 \times 25 = 5 \times 5^2$

(a) 6th term: $5 \times 6^2 = 5 \times 36 = 180$
7th term: $5 \times 7^2 = 5 \times 49 = 245$
$\therefore$ the next two terms of the sequence are **180** and **245**.