

# End of Year Examination Paper 1

## INSTRUCTION TO CANDIDATES:

1. Answer **all** questions.
2. Write your answers and working in the spaces provided.
3. Omission of essential working will result in loss of marks.
4. Calculators may be used in this paper.
5. If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer correct to three significant figures. Give answers in degrees correct to one decimal place.

Marks Obtained
50

**Duration: 1h 30 min**

- 1** (a) Express 4851 as the product of its prime factors, leaving your answer in index notation.  
(b) Hence, find the smallest positive integer  $k$ , such that product of  $4851k$  is a perfect square.

*Ans:* (a) \_\_\_\_\_ [2]

(b)  $k =$  \_\_\_\_\_ [1]

**2** Expand

- (a)  $(2xy^2)(3yz)^2$ ,  
(b)  $(m - 2n)(2n + 3m)$ .

*Ans:* (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

**3** Factorise the following expressions completely.

- (a)  $m^3 - 25m$   
(b)  $8x^2 - 10x - 25$

*Ans:* (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

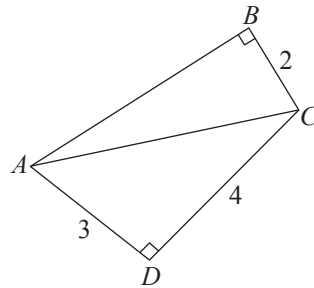
- 4 Given that  $a^2 + b^2 = 12$  and  $(a + b)^2 = 25$ , calculate the value of
- $ab$ ,
  - $(3a - 3b)^2$ .

Ans: (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

- 5 The diagram shows a quadrilateral  $ABCD$  comprising of two right-angled triangles. Given that  $BC = 2$  cm,  $AD = 3$  cm and  $CD = 4$  cm, find

- the length of  $AC$ ,
- the area of  $\triangle ABC$ .



Ans: (a)  $AC =$  \_\_\_\_\_ cm [2]

(b) Area = \_\_\_\_\_  $\text{cm}^2$  [2]

- 6 Sam bought 25 pens, consisting of ballpoint pens or felt-tip pens. Each ballpoint pen cost 70 cents while each felt-tip pen cost \$1.20. He spent \$21.50 altogether. Find the number of ballpoint pens bought.

Ans: \_\_\_\_\_ [4]

- 7**  $y$  is inversely proportional to  $(x - 1)^2$ . Given that  $y = \frac{9}{2}$  when  $x = 3$  and that  $x > 1$ , find
- (a) an equation connecting  $x$  and  $y$ ,
  - (b) the value of  $x$  when  $y = \frac{18}{25}$ .

*Ans:* (a) \_\_\_\_\_ [2]

(b)  $x =$  \_\_\_\_\_ [2]

- 8** Solve the pair of simultaneous equations by elimination.

$$\begin{aligned} 3x + y &= -6 \\ 4x + 5y &= -19 \end{aligned}$$

*Ans:*  $x =$  \_\_\_\_\_

$y =$  \_\_\_\_\_ [3]

- 9 In a class of 35 students, 15 walk to school,  $x$  takes the bus, and the rest takes the MRT train. A student is selected from the class randomly.
- (a) Find the probability that the student walks to school.
- (b) The probability that the student chosen takes the train is  $\frac{2}{7}$ . Find the value of  $x$ .

Ans: (a) \_\_\_\_\_ [1]

(b)  $x =$  \_\_\_\_\_ [3]

- 10 Simplify the following, giving your answer in the lowest terms.

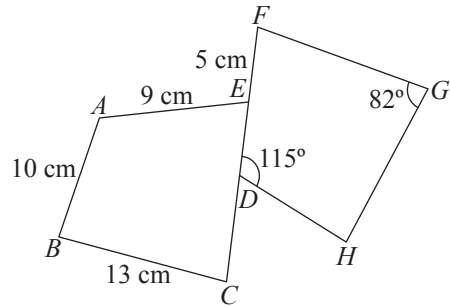
(a)  $\frac{x^2}{y} \div \frac{3}{xy}$

(b)  $\frac{21p^3}{3q^3} \times \frac{6q^2p}{(3p^2)^2}$

Ans: (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [3]

- 11** In the diagram below,  $ABCE \cong DHGF$ . Given that  $AE = 9$  cm,  $AB = 10$  cm,  $BC = 13$  cm,  $EF = 5$  cm,  $\angle FDH = 115^\circ$  and  $\angle FGH = 82^\circ$ . Find
- $\angle BAE$ ,
  - the length  $DE$ .



*Ans:* (a)  $\angle BAE =$  \_\_\_\_\_  $^\circ$  [1]

(b)  $DE =$  \_\_\_\_\_ cm [2]

- 12** A teacher has a total of \$350 to buy some files. Each file cost \$7.20. Find the maximum number of files the teacher can buy.

*Ans:* \_\_\_\_\_ [2]

- 13** Cone  $A$  has a base area of  $x \text{ cm}^2$  while Cone  $B$  has a base area of  $2x \text{ cm}^2$ . Given that ratio of the heights of Cone  $A$  to that of Cone  $B$  is  $3 : 5$ , calculate the value of  $\frac{\text{Volume of Cone } A}{\text{Volume of Cone } B}$ .

*Ans:*  $\frac{\text{Volume of Cone } A}{\text{Volume of Cone } B} = \underline{\hspace{2cm}}$  [2]

- 14** (a) Find the median of 22, 3, 17, 9, 10, 12, 2, 22.  
(b) The mean of five **integer** numbers is 8, the median is 10, and the mode is 3.  
(i) Find the total sum of the 5 numbers.  
(ii) List the 5 numbers.

*Ans:* (a)  $\underline{\hspace{2cm}}$  [1]

(b)(i)  $\underline{\hspace{2cm}}$  [1]

(b)(ii)  $\underline{\hspace{0.5cm}}, \underline{\hspace{0.5cm}}, \underline{\hspace{0.5cm}}, \underline{\hspace{0.5cm}}, \underline{\hspace{0.5cm}}$  [2]

**Solutions to:**

# End of Year Examination Paper 1

1. (a) 

3	4851
3	1617
11	539
7	49
7	7
	1

 $4851 = 3^2 \times 7^2 \times 11$

(b)  $k = 11$

2. (a)  $(2xy^2)(3yz^2) = (2xy^2)(9y^2z^2)$   
 $= 18xy^4z^2$

(b)  $(m - 2n)(2n + 3m) = 2mn + 3m^2 - 4n^2 - 6mn$   
 $= 3m^2 - 4mn - 4n^2$

3. (a)  $m^3 - 25m = m(m^2 - 25)$   
 $= m(m + 5)(m - 5)$

(b) 

X	4x	5
2x	8x <sup>2</sup>	10x
-5	-20x	-25

$\therefore 8x^2 - 10x - 25 = (2x - 5)(4x + 5)$

4. (a)  $(a + b)^2 = a^2 + b^2 + 2ab$   
 $25 = 12 + 2ab$   
 $2ab = 13$   
 $ab = \frac{13}{2}$

(b)  $(3a - 3b)^2 = (3a)^2 - 2(3a)(3b) + (3b)^2$   
 $= 9a^2 - 18ab + 9b^2$   
 $= 9(a^2 + b^2) - 18(ab)$   
 $= 9(12) - 18\left(\frac{13}{2}\right)$   
 $= -9$

5. (a) Using Pythagoras' Theorem on  $\triangle ADC$ ,  
 $AC^2 = 3^2 + 4^2$   
 $= 25$   
 $AC = \sqrt{25}$   
 $= 5 \text{ cm}$

(b) Using Pythagoras' Theorem on  $\triangle ABC$ ,  
 $AB^2 = 5^2 - 2^2 = 21$   
 $AB = \sqrt{21} \text{ cm}$   
 $\text{Area of } \triangle ABC = \frac{1}{2} \times AB \times BC$   
 $= \frac{1}{2} \times \sqrt{21} \times 2$   
 $= \sqrt{21} \text{ cm}^2$   
 $= 4.58 \text{ cm}^2 \quad (3 \text{ s.f.})$

6. Let  $x$  be the number of ballpoint pens bought.  
 $(25 - x)$  is the number of felt-tip pens bought.

$0.7x + 1.2(25 - x) = 21.50$

$0.7x + 30 - 1.2x = 21.50$

$-0.5x = -\frac{17}{2}$

$x = 17$

$\therefore 17$  ballpoint pens were bought.

7. (a)  $y = \frac{k}{(x-1)^2}$ , where  $k$  is a constant.

$\frac{9}{2} = \frac{k}{(3-1)^2}$

$2k = 36$

$k = 18$

$\therefore y = \frac{18}{(x-1)^2}$

(b)  $\frac{18}{25} = \frac{18}{(x-1)^2}$

subst.  $y = \frac{18}{25}$

$(x-1)^2 = 25$

$x-1 = \pm\sqrt{25}$

$x-1 = 5$

$x = 6$

or  $x-1 = -5$

$x = -4$  (rej.  $\because x > 1$ )

$\therefore x = 6$

8.  $3x + y = -6$  — ①

$4x + 5y = -19$  — ②

①  $\times 5$ :

$15x + 5y = -30$  — ③

③  $-$  ②:

$(15x + 5y) - (4x + 5y) = -30 - (-19)$

$11x - 4x = -30 + 19$

$7x = -11$

$x = -1$

Substituting  $x = -1$  into ①,

$3(-1) + y = -6$

$-3 + y = -6$

$y = -6 + 3$

$= -3$

$\therefore x = -1$  and  $y = -3$

9. (a)  $P(\text{walk}) = \frac{15}{35} = \frac{3}{7}$

(b) Number of students taking the train

$= 35 - 15 - x$

$= 20 - x$

$\therefore \frac{20-x}{35} = \frac{2}{7}$

$\frac{20-x}{35} = \frac{10}{35}$

same denominator

$20 - x = 10$

$x = 10$

comparing the numerators

$$10. (a) \frac{x^2}{y} \div \frac{3}{xy} = \frac{x^2}{y} \times \frac{xy}{3}$$

$$= \frac{x^3}{3}$$

$$(b) \frac{21p^3}{3q^3} \times \frac{6q^2p}{(3p^2)^2} = \frac{7p^3}{q} \times \frac{2p}{9p^4}$$

$$= \frac{7}{q} \times \frac{2}{3}$$

$$= \frac{14}{3q}$$

11. (a) Since  $ABCE \equiv DHGF$ ,  
 $\angle BAE = \angle HDF$   
 $= 115^\circ$

(b) Since  $ABCE \equiv DHGF$ ,  
 $DF = AE$   
 $= 9 \text{ cm}$   
 $\therefore DE = DF - EF$   
 $= 9 - 5$   
 $= 4 \text{ cm}$

12. Let  $n$  be the number of files bought.

$$\therefore 7.20n \leq 350$$

$$n \leq \frac{350}{7.2}$$

$$n \leq 48.61$$

Since  $n$  is an integer, the maximum number of files that can be bought is 48.

13. Volume of cone  $= \frac{1}{3} \times \text{base area} \times \text{height}$

$$\therefore \frac{\text{Volume of } A}{\text{Volume of } B} = \frac{\frac{1}{3}(x)(3)}{\frac{1}{3}(2x)(5)}$$

$$= \frac{3x}{10x}$$

$$= \frac{3}{10}$$

14. (a) Arranging in ascending order,

2, 3, 9, 10, 12, 17, 22, 22

$$\text{Median} = \frac{10 + 12}{2}$$

$$= 11$$

(b) (i) Sum of 5 numbers  $= 8 \times 5$   
 $= 40$

(ii) Since the median  $= 10$ , the 3<sup>rd</sup> number (middle position) is 10.

Also, mode  $= 3$  means '3' appears more than once.

Hence, we have 3, 3, 10, —, —.

$$\text{Sum of 4<sup>th</sup> and 5<sup>th</sup> numbers}$$

$$= 40 - (3 + 3 + 10)$$

$$= 24$$

Since the 4<sup>th</sup> and 5<sup>th</sup> numbers are  $\geq 10$ , we have these possibilities:

	4 <sup>th</sup>	5 <sup>th</sup>	Remarks
possibilities	10	14	rej. $\therefore$ mode is 10 and 3
	11	13	accepted
	12	12	rej. $\therefore$ mode is 12 and 3

Hence, the 5 numbers are 3, 3, 10, 11, 13.