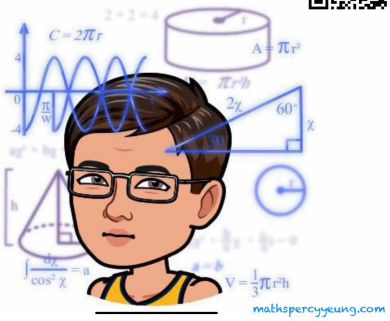
**2023-24**
**F.3 MATHS**
**Final Exam**
**PAPER 1**




| Mark | /100 |
|---|---|
| Parent's Signature | |

2023-2024 Final Examination

**F.3 MATHEMATICS Paper 1**

**Question-Answer Book**

8 : 30 a.m. - 10 : 00 a.m. ( 90 mins. )

Date : 7th June, 2024.

This paper must be answered in English .

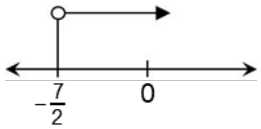
| Name | |
|---|---|
| Class | |
| Class Number | |

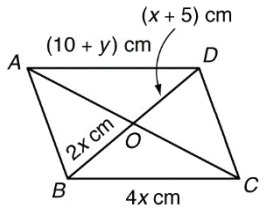
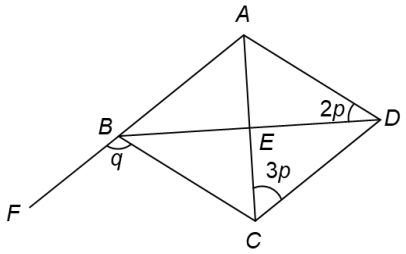
Read carefully the following instructions :

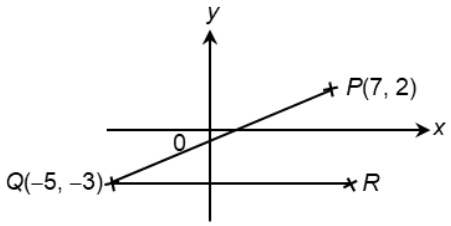
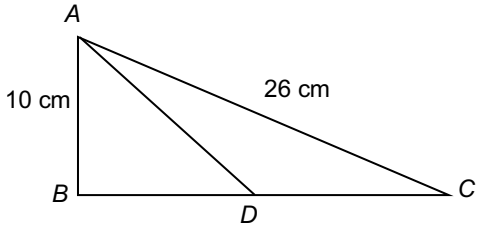
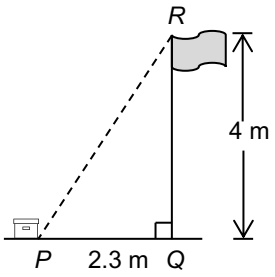
1. This paper must be answered in English.
2. When told to open this question answer book, you should check that all the questions are there. The words 'END OF PAPER' should appear after the last question.
3. Read the questions carefully. Attempt **ALL** questions. This paper consists of 21 questions in section A and 14 questions in section B.
4. Write all your answers in the spaces provided in this Question-Answer Book.
5. In section B, show all steps and geometrical reasons clearly.
6. Unless otherwise specified, numerical answers should be either *exact* or *correct to 3 significant figures*.
7. The diagrams in this paper are not necessarily drawn to scale.

| Question No. | Marker 's Use Only | |
|---|---|---|
| **Section A** | | **30** |
| **1-8** | | **11** |
| **9-13** | | **7** |
| **14-18** | | **7** |
| **19-21** | | **5** |
| **Section B** | | **70** |
| **1** | | **5** |
| **2-3** | | **8** |
| **4-5** | | **9** |
| **6-7** | | **9** |
| **8** | | **6** |
| **9-10** | | **8** |
| **11** | | **5** |
| **12** | | **5** |
| **13** | | **6** |
| **14** | | **9** |
| **Total** | | **100** |

**Section A: Write your answers in the spaces provided. Working need not be shown. (30 marks)**

| | | |
|---|---|---|
| **1.** | **(a)** Factorize $21x^2 - 7xy - 42x$.<br>**(b)** Factorize $2y^2 - 12y - 5y + 30$.<br>**(c)** Factorize $36c^2 - 25$.<br>**(d)** Factorize $5y^2 - 11y + 2$. | |
| **2.** | How many minutes are there in 30 days? Express your answer in scientific notation.. | |
| **3.** | Simplify $(7a)^2 \times (a^3)^5$ and express your answer with a positive index. | |
| **4.** | Convert $42_{10}$ into binary numbers. | |
| **5.** | Write down an inequality in $x$ whose solutions are represented by the following diagram.<br>  | |
| **6.** | If $x < y$, fill in the blank with appropriate inequality signs '>' or '<'.<br>$5(3 - x)$ _____ $5(3 - y)$ | |
| **7.** | The cost of a printer depreciates at a constant rate of 15% per quarter, what is the decay factor? | |
| **8.** | Jacky deposits \$45 000 in a bank. 3 years later, he will obtain a simple interest of \$5400. Find the annual interest rate. | |

| | | |
|---|---|---|
| **9.** | Jessie deposits \$90 000 in a bank. The interest rate is 3% p.a. compounded yearly. Find the compound interest she will receive after 4 years. (Give your answer correct to the nearest integer.) | |
| **10.** | In the figure, *ABCD* is a parallelogram. The diagonals *AC* and *BD* intersect at *O*. Find the unknowns.<br>  <br><br>**(a)** Find the value of $x$.<br>**(b)** Find the value of $y$. | |
| **11.** | In the figure, *ABCD* is a rhombus. The diagonals *AC* and *BD* intersect at *E*. *AB* is produced to *F*.<br>  <br><br>**(a)** Find the value of $p$.<br>**(b)** Find the value of $q$. | |
| **12.** | The perimeter of the largest cross-section of a sphere is $22\pi$ cm. Find the surface area of the sphere in terms of $\pi$. | |
| **13.** | The slant height of a right circular cone is 16 cm. If the curved surface area of the cone is $128\pi$ cm$^2$, find its base diameter. | |

| | | |
|---|---|---|
| **14.** | The figure shows two line segments $PQ$ and $QR$ of equal length, where $QR$ is a horizontal line segment.<br>  <br><br>**(a)** Find the length of $PQ$.<br>**(b)** Find the coordinates of $R$. | |
| **15.** | In the figure, $AB$ is an altitude of $\triangle ABC$ and $AD$ is a median of $\triangle ABC$. Find the length of $BD$<br>  <br> | |
| **16.** | Find the value of $\dfrac{\cos 60° \tan 30°}{\sin^2 45°}$ without using a calculator. (Leave your answer in surd form.) | |
| **17.** | In the figure, the top $R$ of a flagpole is 4 m above the ground and the horizontal distance between a box $P$ and the flagpole is 2.3 m. Find the angle of elevation of $R$ from $P$.<br>  <br> | |
| **18.** | If the mean of $a$, $b$, $c$, $d$ and $e$ is 12, find the means of the following data sets.<br>**(a)** $-2a$, $-2b$, $-2c$, $-2d$, $-2e$<br>**(b)** $3 - 2a$, $3 - 2b$, $3 - 2c$, $3 - 2d$, $3 - 2e$ | |

| | | |
|---|---|---|
| **19.** | The mode of the data shown in the following stem-and-leaf diagram is 48.<br>Stem (10) \| Leaf (1)<br>2 \| 2 3 $a$ 5<br>3 \| 0 1 6 $b$ $c$ 9<br>4 \| 1 8 8<br>Write down the values of<br>(a) $a$,<br>(b) $b$,<br>(c) $c$. | |
| **20.** | An integer is chosen at random from 11 to 30 inclusive. Find the probability of getting a prime number. | |
| **21.** | A ball is drawn at random from 4 balls marked with numbers 4, 11, 15 and 19 respectively. Find the expected value of the number shown on the ball drawn. | |

**Section B: All working must be clearly shown. Write the mathematical expressions, answers and statements/conclusions in the spaces provided. (70 marks)**

**1.** Factorize

**(a)** $uv^2 - v^2$,

**(b)** $u^2 - 6u + 5$,

**(c)** $uv^2 - v^2 + u^2 - 6u + 5$.

(5 marks)

**2.** (a) Solve the inequality $\frac{4x-11}{3} < 5x$ and represent the solutions graphically.

(b) Write down the smallest possible integer that satisfies the inequality in (a).

(5 marks)

**3.** Yuki borrowed \$36 000 from a bank at an interest rate of 14% p.a. compounded quarterly. Find the amount she had to repay after 9 months. (Give your answer correct to the nearest integer.)

(3 marks)

**4.** **(a)** Simplify $\left(\frac{5a^{-1}}{8b^{0}}\right)^{-2}$ and express your answer with positive indices.

**(b)** Simplify $\left(\frac{8^{n+1}}{4}\right)^{2}$, where n is a positive integer. Express your answer with a positive index.

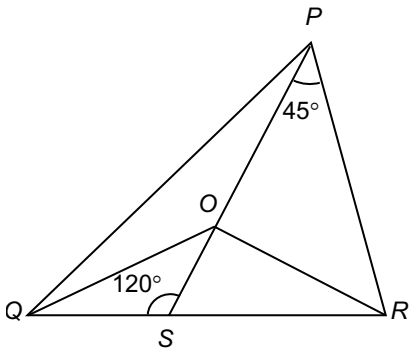
(6 marks)

**5.** In the figure, *ABCD* is a rectangle and *BFED* is a parallelogram. *ADE*, *BFC*, *CGD* and *EGF* are straight lines. Prove that $x + y = 90°$ (3 marks)

**6.** In the figure, $O$ is the circumcentre of $\triangle PQR$. $PO$ is produced to meet $QR$ at $S$. $\angle OPR = 45°$ and $\angle OSQ = 120°$.

**(a)** Find $\angle ORS$.
**(b)** Find $\angle POQ$.

(5 marks)




**7.** $A(1, 10)$, $B\left(\frac{17}{2}, \frac{-25}{2}\right)$, $C(6, 5)$ and $D(-4, -15)$ are four points on a rectangular coordinate plane.

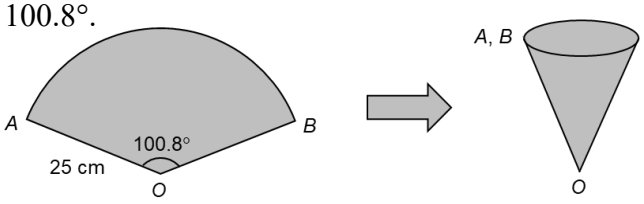
$M$ is a point on $AB$ such that $AM : MB = 2 : 3$.

**(a)** Find the coordinates of $M$.

**(b)** If $M$ is a point on $CD$, find $CM : MD$.

(4 marks)

**8.** In the figure, a paper sector is folded into a cup in the shape of a right circular cone. The radius of the sector is 25 cm and the angle of the sector is 100.8°.

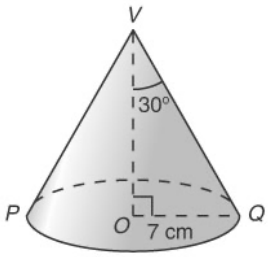



**(a)** Find the base radius of the cup.

**(b)** Are 150 cups enough to hold 0.18 $m^3$ of water? Explain your answer.

(6 marks)

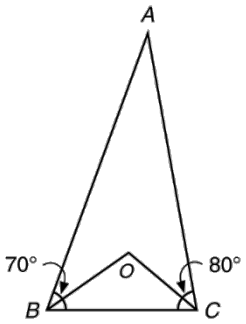
**9.** The figure shows a right circular cone $VPQ$.




Find
**(a)** the volume of the cone,
**(b)** the total surface area of the cone.
(Give your answers correct to 3 significant figures.)

(5 marks)

**10.** In the figure, $O$ is the incentre of $\triangle ABC$. $\angle ABC = 70°$ and $\angle ACB = 80°$. Find $\angle BOC$.




(3 marks)

**11. (a)** Simplify $\sin\theta\sqrt{\tan^2(90°-\theta)+1}$.

**(b)** Simplify $\dfrac{(\sin\theta-\cos\theta)^2}{1-2\sin\theta\cos\theta}-\sin^2(90°-\theta)$.

(5 marks)

**12.** Jason tosses a fair coin and throws a fair dice. Let H stand for a head and T stand for a tail.

**(a)** List all the possible outcomes in the given table.

| | | Dice | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** |
| **Coin** | **H** | | | | | | |
| | **T** | | | | | | |

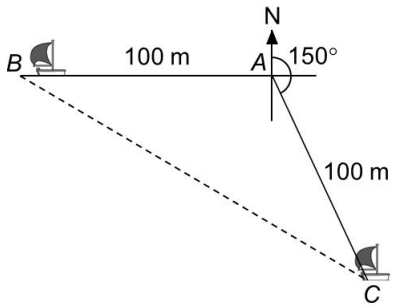
**(b)** Find the probability of getting

**(i)** a tail and an even number,

**(ii)** a head and a number smaller than 3.

(5 marks)

**13.** In the figure, two ships *B* and *C* leave island *A* at the same time. Ship *B* sails westwards 100 m, while ship *C* sails 100 m in the direction 150°.




**(a)** Find the compass bearing of *C* from *B*.

**(b)** What is the distance between ships *B* and *C*?

(Give your answers correct to 3 significant figures if necessary.)

(6 marks)

**14.** Referring to the figure, $AM$ is produced to meet the $y$-axis at $B$ and $AM = MB$. $N$ is a point on the $x$-axis such that $NM \perp AB$.

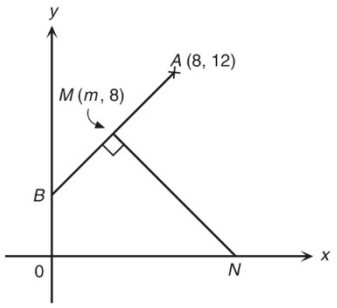
**(a)** Find the value of $m$ and the coordinates of $B$.

**(b)** Find the coordinates of $N$.

**(c)** If $C$ and $D$ are points on the $x$-axis such that $AC$ // $MN$ // $BD$,

**(i)** find the coordinates of $C$ and $D$,

**(ii)** Is $N$ the mid-point of $DC$? Explain your answer.




(9 marks)