# SY 20-21 F.3 Maths Final Exam Paper 1

**Final Examination, 2020 – 2021**

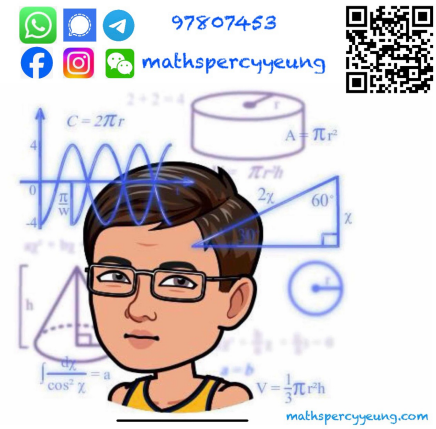
**Mathematics**

Class: F.3 (  )  Time allowed: 1.5 hours

Name: _____ (  )  Marks: _____ / 100

- Attempt ALL questions in this paper.
- Write your answers in the spaces provided in this Question-Answer Book.
- Unless otherwise specified, all working must be clearly shown.
- Unless otherwise stated, numerical answers should either be exact or correct to 3 significant figures.
- The diagrams in this paper are not necessarily drawn to scale.

1. Simplify $\frac{(x^{-5}y)^3}{x^2}$ and express your answer with positive indices. (3 marks)




2. Consider the following integers:

8  8  4  2  4  8  1

Find the mean, median and mode of the above integers. (4 marks)

3. Factorize

(a) $3x^2 + 7xy + 2y^2$,

(b) $6x + 2y - 3x^2 - 7xy - 2y^2$.

(5 marks)

4. The radius of a solid sphere is 6 cm . Find

(a) the volume of the sphere,

(b) the surface area of the sphere,

(4 marks)

5. In Figure 1, $ABCD$ is a parallelogram. $E$ is a point lying on $AD$ such that $AE = BE$. It is given that $\angle AEB = 54°$. Find $\angle ADC$. (4 marks)

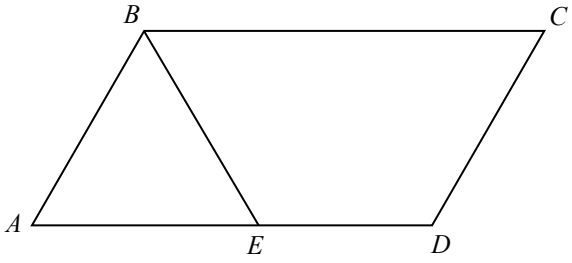



Figure 1

6. The number of patients infected with disease $W$ decreases by $5\%$ per day. If the number of infected patients on a certain day is $5\,415$, find the number of infected patients on two days ago. (3 marks)

7. Consider the compound inequality

$$\frac{1-4x}{3} \leq 3 \quad \text{and} \quad x+4<10 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (*) .$$

(a) Solve (*) and represent the solution graphically.

(b) Write down the number of positive integers satisfying (*).

(7 marks)

8. Let $x>0$. Solve the equation $4\sqrt[3]{x^2}-11=25$. (4 marks)

9. In Figure 2, $AHC$ is the horizontal ground. $BH$ is perpendicular to $AC$. It is given that $AB = 15$ m and $CH = 4$ m. The angle of elevation of $B$ from $A$ is $38°$.

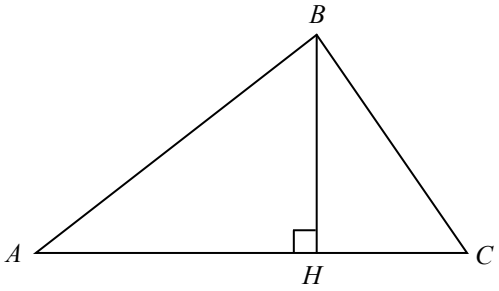



Figure 2

Find

(a) $BH$,

(b) the angle of depression of $C$ from $B$.

(6 marks)

10. Adrian has a principal of $ 10 000. He is considering two saving plans as follows:

Plan $A$: A simple interest rate of 8% per annum.

Plan $B$: A interest rate of 6% per annum, compounded half-yearly.

If the period of deposit is 10 years, which plan should he choose? Explain your answer. (7 marks)

11. In Figure 3, $OABC$ is a quadrilateral, where $O$ is the origin. $AC$ and $OB$ intersect at $M$. It is given that $M$ is the mid-point of $AC$.

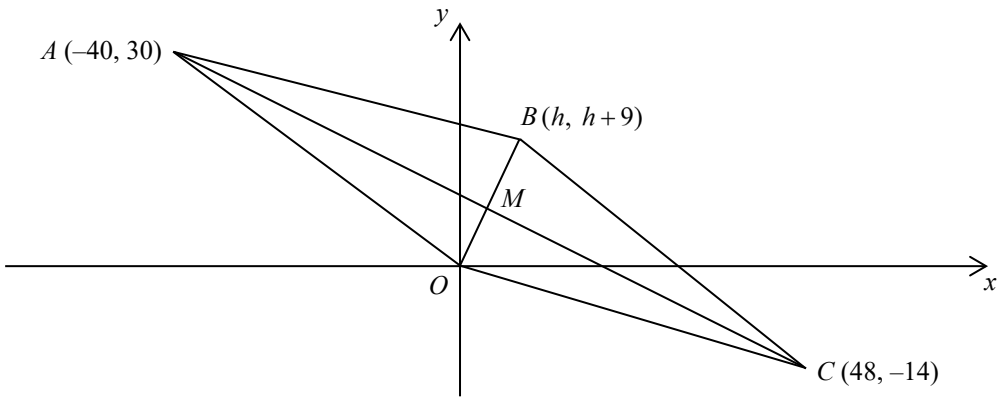



Figure 3

(a) Find the coordinates of $M$.

(b) Find the equation of the line passing through $O$ and $M$.

(c) Find the coordinates of $B$.

(d) Chris claims that $OABC$ is a rhombus. Is the claim correct? Explain your answer.

(8 marks)

12. In Figure 4, $ABCD$ is a parallelogram. $AC$ and $BD$ intersect at $O$. $P$ and $Q$ are the mid-points of $AB$ and $BC$ respectively.

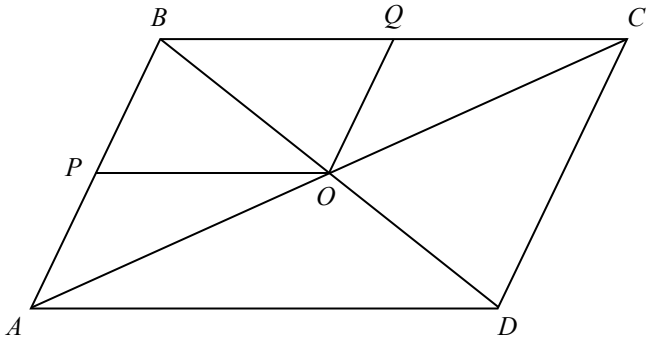



Figure 4

Prove that

(a) $PO = \frac{1}{2}BC$,

(b) $OPBQ$ is a parallelogram.

(6 marks)

13. (a) Factorize $x^3 - 1$.

(b) Hence, or otherwise, solve $x^3 - 7x + 6 = 0$.

(7 marks)

14. An inverted right circular conical container of base radius 12 cm and height 16 cm is held vertically. $96\pi$ cm$^3$ of water are poured into the container.

(a) Find

(i) the capacity of the container,

(ii) the depth of water in the container.

(b) Some water is now poured into the container such that the wet curved surface area is increased by $75\pi$ cm$^2$. Find the new depth of water in the container.

(8 marks)

15. The table below shows the distribution of the numbers of assignments missed by a group of students on a certain day.

| Number of missing assignments | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Number of students | 5 | 3 | 2 | 7 | 3 |

(a) Find the median of the distribution.

(b) Three more students join the group. The numbers of assignments missed by these students are $a$, $b$ and $c$ respectively.

(i) Simon claims that the median must be changed. Do you agree? Explain your answer.

(ii) It is given that the mean of the distribution unchanged after the three students are joined.

(1) Find $a+b+c$.

(2) Furthermore, the median is decreased by $0.5$. Write down two sets of possible values of $a$, $b$ and $c$.

(8 marks)

16. In Figure 5, $ABCDEFGH$ is a rectangular block. $M$ is the mid-point of $DE$. It is given that $AB = 15$ cm, $BC = 20$ cm and $DE = 16$ cm.

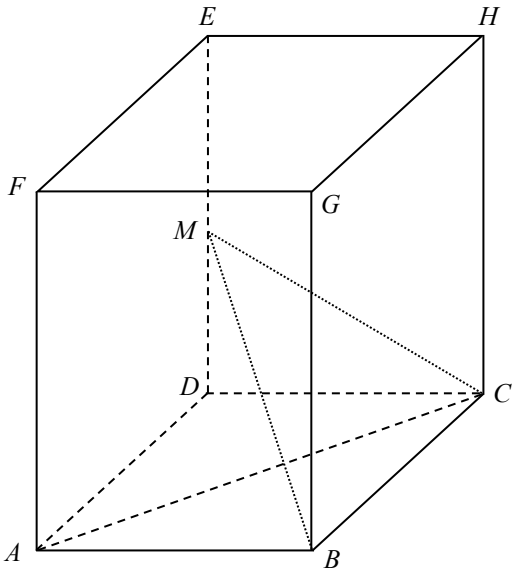



Figure 5

Find

(a) the angle between $BM$ and the plane $ABCD$,

(b) the angle between the plane $BCM$ and the plane $ABC$.

(6 marks)

17. The coordinates of $A$ and $B$ are $(24, 36)$ and $(36, 0)$ respectively. Denote the circumcentre and orthocentre of $\Delta OAB$ by $J$ and $H$ respectively, where $O$ is the origin.

(a) Write down the $x$-coordinates of $J$ and $H$.

(b) Find the coordinates of $J$ and $H$.

(c) Denote the mid-points of $OA$, $OB$, $AB$ and $JH$ by $C$, $D$, $E$ and $M$ respectively.

(i) Show that $CM = DM = EM$.

(ii) Write down the type of centre of $M$ with respect to $\Delta CDE$.

(10 marks)

**End of Paper**