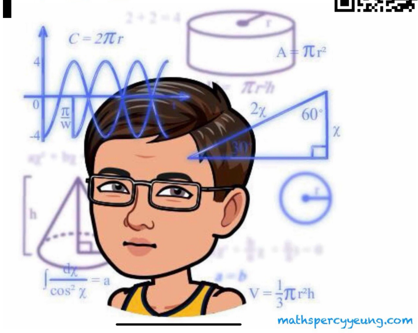
SY 21-22 F.3 Maths Final Exam Paper 1



Final Examination, 2021-2022
Mathematics Paper 1

Time allowed: 1.5 hours
Form 3
Full Marks: 100

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

1. Simplify $\dfrac{b^4}{(a^{-2}b)^3}$ and express your answer with positive indices.

(4 marks)

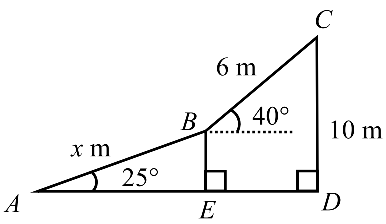
2. Factorize
(a) $x^2+8x+16$,
(b) $x^2-3xy+8x-12y+16$.

(4 marks)

3. Mike deposited \$50000 at an interest rate 4% p.a. compounded half-yearly. Find the interest he will earn after 3 years. Correct your answer to the nearest dollar.

(4 marks)

4. In the figure, A, E and D are the points on a horizontal ground. CD and BE are two vertical flag poles. It is given that $AB = x$ m, $BC = 6$ m and $CD = 10$ m. If the angles of elevation from A to B and from B to C are 25° and 40° respectively, find x.



(3 marks)

5. If the distance between (–2, 0) and $(a, 2a)$ is 10 , find the two possible values of a .

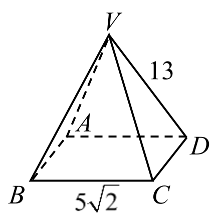
(5 marks)

6. (a) Solve $\dfrac{2x-1}{3}>1+\dfrac{x}{5}$ and represent your answer graphically.
(b) Hence solve $\left(\dfrac{2x-1}{3}>1+\dfrac{x}{5} \text{ and } 2\le x\le 5\right)$.

(6 marks)

7. In a right pyramid $VABCD$, the base $ABCD$ is a square. It is given that $VD = 13$ and $BC = 5\sqrt{2}$. Find the volume of $VABCD$.

(5 marks)



8. If one of the solutions of $2x^2 + nx - 12 = 0$ is 4 , where n is a constant, find
   (a) n ,
   (b) the other solution.

(5 marks)

9. The table below shows the number of siblings of the students in a class in January.

The number of siblings of a student	0	1	2	3
The number of students	3	13	5	4

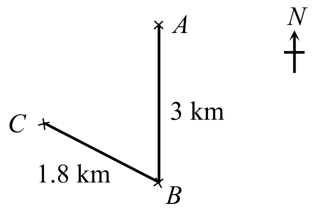
   (a) Find the mean, median and mode of the number of siblings of students.
   (b) There will be n students with exactly 1 sibling withdraw in the next academic year. If the median and the mode do not change, write down the greatest possible value of n .
   (c) 5 students will join the class in the next month. With these students, w student(s) do not have sibling, x student(s) have 1 sibling, y student(s) have 2 siblings and z student(s) have 3 siblings. If the mean, median and mode do not change, write down a set of possible values of w, x, y and z .

(7 marks)

10. There are four balls in a bag, 2 red balls (R_1 and R_2), 1 blue ball (B) and 1 green ball (G). Two balls are drawn randomly from the bag one by one with replacement.
   (a) List out all possible outcomes by using a table.
   (b) Using (a), or otherwise, find the probability of getting 2 balls with the same colour.
   (c) Mark says if getting 2 balls at the same time, the probability of getting the same colour is the same as in (b). Do you agree? Explain your answer.

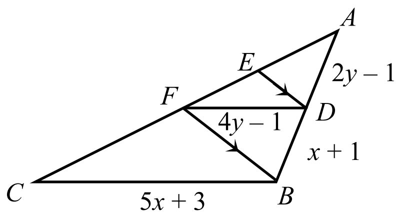
(6 marks)

11. A man rides a bicycle from A to B, where B is 3 km due south of A . Then he rides 1.8 km to C in the direction N60°W.
   (a) Find the true bearing of C from A .
   (b) Find AC .



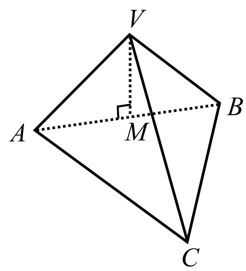
(6 marks)

12. In the figure, F and E are the mid-points of AC and AF respectively. It is given that ED // FB . Find the values of x and y .



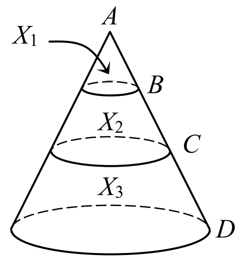
(6 marks)

13. In the figure, $VABC$ is a tetrahedron. M is the mid-point of AB . It is given that V is vertically above M . $AB = BC = CA = 4$ and $VA = VB = 3$.
   (a) Find VM .
   (b) Find the angle between VC and plane ABC .



(6 marks)

14. In the figure, a right circular cone is divided into 3 parts (X_1, X_2 and X_3) by two planes which are parallel to its base. AD is the slant height of the original cone, while B and C are the points on the slant height that are cut by the parallel planes. Let the curved surface areas of X_1, X_2 and X_3 be S_1, S_2 and S_3 respectively. It is given that $S_1 : S_2 : S_3 = 1 : 8 : 27$.

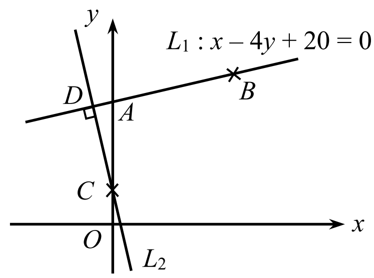


(a) Find $AB : AC : AD$.

(b) If the volume of X_2 is 78 cm^3, find the volume of the original cone.

(6 marks)

15. In the figure, $L_1 : x - 4y + 20 = 0$ passes through B and cuts the y-axis at A . The x-coordinate of B is 4 .



(a) Find the coordinates of A .

(b) C is a point on OA such that $OC : CA = 2 : 3$. L_2 passes through C and intersects L_1 at D . It is given that $L_2 \perp L_1$.

(i) Write down the coordinates of C .

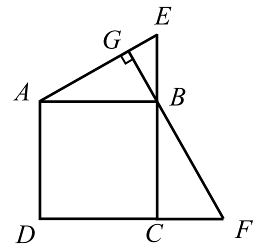
(ii) Find the equation of L_2 .

(iii) Find the coordinates of D .

(iv) Find the area of ΔBCD .

(11 marks)

16. In the figure, $ABCD$ is a square. CBE, DCF and FBG are straight lines. It is given that $AE \perp GF$.

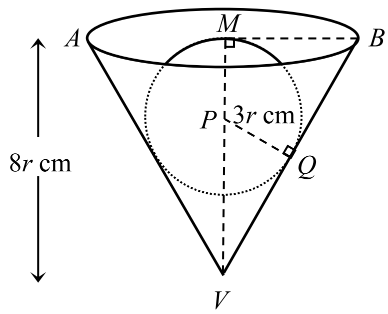


(a) Prove that $\Delta ABE \cong \Delta BCF$.

(b) If $DF = 23$ and $AE = 17$, find DC .

(7 marks)

17. In the figure, an inverted right circular conical container VAB contains some water inside it. When a sphere is put into it, a point M, which is the centre of the base circle of the container, lies on the surface of the sphere. The radius PQ of the sphere is $3r$ cm and the height of the container is $8r$ cm.



(a) Find VQ and MB in terms of r .

(b) If there are 240π cm^3 of water in the container and the water level reaches the base circle without overflow, find r .

(9 marks)

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