

PRACTICE QUESTIONS
MATHEMATICS Compulsory Part
Question-Answer Book

Instructions

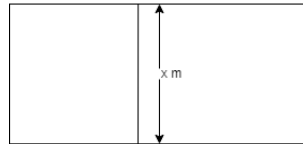
1. This paper must be answered in English.
2. Unless otherwise specified, all working must be clearly shown.
3. Unless otherwise specified, numerical answers must be exact.
4. This paper is for **internal use** only.
5. All questions are collected from AL/CE/DSE past papers, reference site:
<https://www.dse.life/ppindex/m2/>

1. Let $f(x) = \frac{1}{2}x - \frac{1}{144}x^2 - 6$. Using the method of completing the square, find the coordinates of the vertex of the graph of $y = f(x)$.

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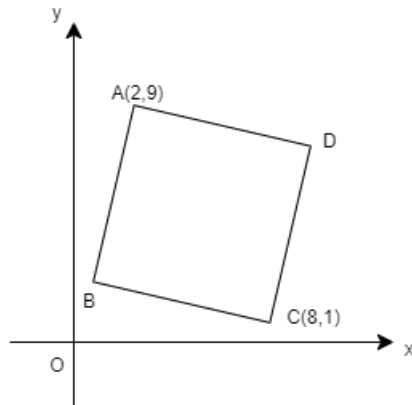
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3. (a) Let $f(x) = 36x - x^2$. Using the method of completing the square, find the coordinates of the vertex of the graph of $y = f(x)$.
- (b) The length of a piece of string is 108m. A guard cuts the string into two pieces. One piece is used to enclose a rectangular restricted zone of area $A \text{ m}^2$. The other piece is used to divide this restricted zone into two rectangular regions as shown in the figure.



- Express A in terms of x .
- The guard claims that the area of this restricted zone can be greater than 500 m^2 . Do you agree? Explain your answer.

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- (a) Find
 - i. the coordinates of E ,
 - ii. the equation of BD .
- (b) It is given that the equation of AD is $x + 7y - 65 = 0$. Find
 - i. the equation of BC ,
 - ii. the length of AB .

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- [illegible]

8. Factorize

(a) $x^3 + x^2y - 7x^2$.

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

9. Factorize

(a) $4m^2 - 9$.

(b) $2m^2n + 7mn - 15n$.

(c) $4m^2 - 9 - 2m^2n - 7mn + 15n$

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11. If $3x^2 - kx - 2$ is divisible by $x - k$, find the two values of k .

[illegible]

- [illegible]

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, providing a guide for handwriting or typing. The paper itself is a clean, off-white color.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]

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16. Let $\log 2 = x, \log 3 = y$. Express the following in terms of x and y .

- (a) $\log 18$.
 (b) $\log 15$.
 (c) $\log \sqrt{12}$.

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17. Solve the following without using calculator:

- (a) $3^x = \frac{1}{\sqrt{27}}$;
(b) $\log x + 2 \log 4 = \log 48$.

[illegible]

18. A researcher defined Scale A and Scale B to represent the magnitude of an explosion as shown in the table:

Scale	Formula
A	$M = \log_4 E$
b	$M = \log_8 E$

It is given that M and N are the magnitudes of an explosion on Scale A and Scale B respectively, while E is the relative energy released by the explosion. If the magnitude of an explosion is 6.4 on Scale B , find the magnitude of the explosion on Scale A .

[illegible]

19. Let a and b be constants. Denote the graph of $y = a + \log_b x$ by G . The x-intercept of G is 9 and G passes through the point $(243, 3)$. Express x in terms of y .

[illegible]

20. Solve the following:

(a) $\begin{cases} 4^{x-y} = 4 \\ 4^{x+y} = 16 \end{cases}$, find x and y .

(b) $3^{2x} + 3^x - 2 = 0$, find x .

(c) $\log_3(x - 3) + \log_3(x + 3) = 3$, find x .

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21. If $2\log_{10} x - \log_{10} y = 0$. Show that $y = x^2$.

[illegible]

22. Solve the following equations:

(a) $1 - 2x = \sqrt{2 - x}$.

(b) $x - \sqrt{x + 1} = 5$.

(c) $x - 5\sqrt{x} - 6 = 0$.

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23. Find the range of values of k for which the equation $2x^2 + x + 5 = k(x + 1)^2$ has no real roots.

24. The quadratic equations $x^2 - 6x + 2k = 0$ and $x^2 - 5x + k$ have a common root α . (i.e. α is a root of both equations.) Show that $\alpha = k$ and hence find the value(s) of k .

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26. If $\frac{1}{m} + \frac{1}{n} = \frac{1}{a}$ and $m + n = b$, express the following in terms of a and b

(a) mn ,

(b) $m^2 + n^2$.

27. Suppose α and β are roots of the equation $kx^2 - 4x + 2k = 0$, where k ($k \neq 0$) is a constant. Express the following in terms of k :

(a) $\alpha^2 + \beta^2$,

(b) $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

28. Express $\frac{1}{1+2i}$ in the form of $a+bi$, where a and b are real numbers.

29. If $a:b=3:4$ and $a:c=2:5$, find

- (a) $a:b:c$,
(b) the value of $\frac{ac}{a^2+b^2}$.

- [illegible]

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- Express y in terms of x .
- Hence, find the value of y when $x = 6$.

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- Find $h(x)$.
- Solve the equation $h(x) = 3x^2$.

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35. Simplify the following:

(a) $\frac{1 - \cos^2 x}{\sin x}$.

(b) $\frac{\sin(180^\circ - \theta)}{\sin(90^\circ + \theta)}$.

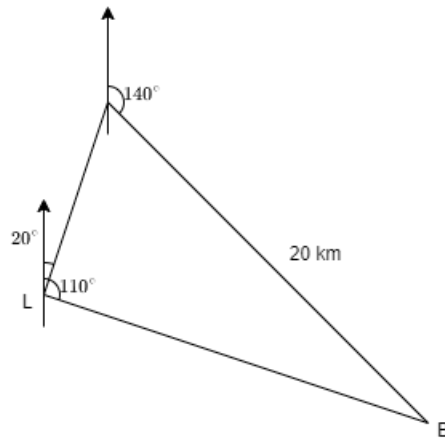
(c) $\sin^2(180^\circ - \phi) + \sin^2(270^\circ + \phi)$.

36. Solve the following with $0^\circ \leq \theta < 360^\circ$. Give your answer in 3 significant figures if needed.

(a) $\sin^2 \theta + 7 \sin^2 \theta = 5 \cos^2 \theta$.

(b) $\sin^2 \theta - 3 \cos \theta - 1 = 0$.

37. In the figure, the bearings of two ships A and B from a light house L are 020° and 110° respectively. B is 20 km and at a bearing of 140° from A .



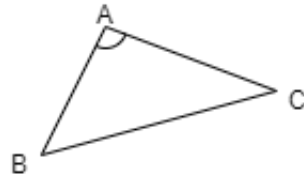
Find

- the distance of L from B ,
- the bearing of L from B .

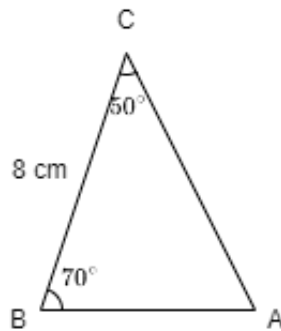
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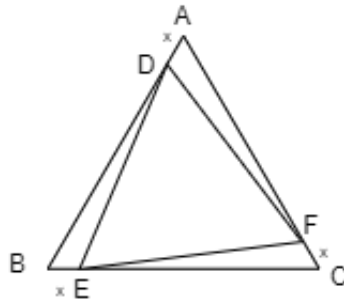
[illegible]

38. In the figure, $AB = 4$, $AC = 5$ and $BC = 7$. Calculate $\angle A$ to the nearest degree.



39. In the figure, find AB and the area of $\triangle ABC$.





- By using the cosine formula or otherwise, express DE^2 in terms of x .
- Show that the area of $\triangle DEF = \frac{\sqrt{3}}{4}(3x^2 - 6x + 4)$.

[illegible]

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