Mathematics-I Solutions

DI01000021 – Summer 2025

Semester 1 Study Material

Detailed Solutions and Explanations

Q.1 [14 marks]

Fill in the blanks/MCQs using appropriate choice from the given options

0.0.1 Q1.1 [1 mark]

**$log *3 1 = $* ____ $**$

Solution

d. 0

Solution: For any base $a > 0, a \neq 1$: $\log_a 1 = 0$ Therefore: $\log_3 1 = 0$

0.0.2 Q1.2 [1 mark]

If $f(x) = e^{x-1}$ then $f(1) = $ ______

Solution

c. 1

Solution: $f(x) = e^{x-1}$ $f(1) = e^{1-1} = e^0 = 1$

0.0.3 Q1.3 [1 mark]

**$log *5 125 = $* ____ $**$

Solution

b. 3

Solution: $\log_5 125 = \log_5 5^3 = 3$ Since $5^3 = 125$

0.0.4 Q1.4 [1 mark]

If $f(x) = x^3 - 7$ then $f(-2) = $ ______

Solution

c. -15

Solution: $f(x) = x^3 - 7$ $f(-2) = (-2)^3 - 7 = -8 - 7 = -15$

0.0.5 Q1.5 [1 mark]

Principal period of $\cos x$ is ______

Solution

c. 2π

Solution: The cosine function repeats every 2π radians, so its principal period is 2π.

0.0.6 Q1.6 [1 mark]

$150^\circ = $______

Solution

a. $\frac{5\pi}{6}$
Solution: Converting degrees to radians: $150° = 150 \times \frac{\pi}{180} = \frac{5\pi}{6}$

0.0.7 Q1.7 [1 mark]

$\sin ^{-1}x + \cos ^{-1}x = $ _______

Solution

a. $\frac{\pi}{2}$
Solution: This is a standard identity: $\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$ **for** $x \in [-1, 1]$

0.0.8 Q1.8 [1 mark]

(1,0,0) $\times(1, 0, 0) =$ _______

Solution

d. (0,0,0)
Solution: Cross product of any vector with itself is zero vector: $(1, 0, 0) \times (1, 0, 0) = (0, 0, 0)$

0.0.9 Q1.9 [1 mark]

If $\vec{a} = 4\hat{i} - 3\hat{j}$ **then $|| = $** _______

Solution

b. 5
Solution: $|\vec{a}| = \sqrt{4^2 + (-3)^2} = \sqrt{16 + 9} = \sqrt{25} = 5$

0.0.10 Q1.10 [1 mark]

If a line makes an angle $45°$ **with positive x-axis then slope of the line is** _______

Solution

c. 1
Solution: Slope $m = \tan(45°) = 1$

0.0.11 Q1.11 [1 mark]

Radius of the circle $x^2 + y^2 = 4$ **is** _______

Solution

d. 2
Solution: Standard form: $x^2 + y^2 = r^2$ **Comparing:** $r^2 = 4$**, so** $r = 2$

0.0.12 Q1.12 [1 mark]

**$lim

0.0.12 Q1.13 [1 mark]

**$lim

0.0.12 Q1.14 [1 mark]

**$lim

Q.2 (A) [6 marks]

Attempt any two

0.0.13 Q2(A).1 [3 marks]

Find value: $\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$

Solution

0

Solution: $\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix} = 1(5 \times 9 - 6 \times 8) - 2(4 \times 9 - 6 \times 7) + 3(4 \times 8 - 5 \times 7)$
$= 1(45 - 48) - 2(36 - 42) + 3(32 - 35) = 1(-3) - 2(-6) + 3(-3) = -3 + 12 - 9 = 0$

0.0.14 Q2(A).2 [3 marks]

Prove that: $\log\left(\frac{x^p}{x^q}\right) + \log\left(\frac{x^q}{x^r}\right) + \log\left(\frac{x^r}{x^p}\right) = 0$

Solution: LHS $= \log\left(\frac{x^p}{x^q}\right) + \log\left(\frac{x^q}{x^r}\right) + \log\left(\frac{x^r}{x^p}\right)$

Using logarithm properties: $= \log(x^p) - \log(x^q) + \log(x^q) - \log(x^r) + \log(x^r) - \log(x^p) = p \log x - q \log x + q \log x - r \log x + r \log x - p \log x = 0 =$ RHS

0.0.15 Q2(A).3 [3 marks]

Find value: $\tan(75°)$

Solution

$2 + \sqrt{3}$
Solution: $\tan(75°) = \tan(45° + 30°)$
Using $\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$:
$\tan(75°) = \frac{\tan 45° + \tan 30°}{1 - \tan 45° \tan 30°} = \frac{1 + \frac{1}{\sqrt{3}}}{1 - 1 \times \frac{1}{\sqrt{3}}} = \frac{1 + \frac{1}{\sqrt{3}}}{1 - \frac{1}{\sqrt{3}}}$
$= \frac{\frac{\sqrt{3}+1}{\sqrt{3}}}{\frac{\sqrt{3}-1}{\sqrt{3}}} = \frac{\sqrt{3}+1}{\sqrt{3}-1} = \frac{(\sqrt{3}+1)^2}{(\sqrt{3}-1)(\sqrt{3}+1)} = \frac{3+2\sqrt{3}+1}{3-1} = \frac{4+2\sqrt{3}}{2} = 2 + \sqrt{3}$

Q.2 (B) [8 marks]

Attempt any two

0.0.16 Q2(B).1 [4 marks]

Prove that: $\frac{1}{\log_{12} 120} + \frac{1}{\log_2 120} + \frac{1}{\log_5 120} = 1$

Solution: Using change of base formula: $\frac{1}{\log_a b} = \log_b a$

LHS $= \log_{120} 12 + \log_{120} 2 + \log_{120} 5$

Using logarithm properties: $= \log_{120}(12 \times 2 \times 5) = \log_{120} 120 = 1 =$ RHS

0.0.17 Q2(B).2 [4 marks]

Solve: $\begin{vmatrix} x & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 3 \end{vmatrix} = 3$

Solution: Expanding along third row: $\begin{vmatrix} x & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 3 \end{vmatrix} = 3 \begin{vmatrix} x & 1 \\ 1 & 2 \end{vmatrix}$

$= 3(2x - 1) = 6x - 3$

Given: $6x - 3 = 3$ $6x = 6$ $x = 1$

0.0.18 Q2(B).3 [4 marks]

If $f(x) = \frac{1-x}{1+x}$ **prove that: (i)** $f(x) + f\left(\frac{1}{x}\right) = 0$ **(ii)** $f(x) \times f(-x) = 1$

Solution: Given: $f(x) = \frac{1-x}{1+x}$

(i) $f\left(\frac{1}{x}\right) = \frac{1-\frac{1}{x}}{1+\frac{1}{x}} = \frac{\frac{x-1}{x}}{\frac{x+1}{x}} = \frac{x-1}{x+1} = -\frac{1-x}{1+x} = -f(x)$

Therefore: $f(x) + f\left(\frac{1}{x}\right) = f(x) + (-f(x)) = 0$

(ii) $f(-x) = \frac{1-(-x)}{1+(-x)} = \frac{1+x}{1-x}$

$f(x) \times f(-x) = \frac{1-x}{1+x} \times \frac{1+x}{1-x} = 1$

Q.3 (A) [6 marks]

Attempt any two

0.0.19 Q3(A).1 [3 marks]

Prove that: $\frac{\sin(180^\circ - x) + (180^\circ - x) + \tan(180^\circ + x)}{\cos(90^\circ + x) + \sec(90^\circ + x) + \cot(90^\circ + x)} = -3$

Solution: Using trigonometric identities:

- $\sin(180^\circ - x) = \sin x$
- $(180^\circ - x) = x$
- $\tan(180^\circ + x) = \tan x$
- $\cos(90^\circ + x) = -\sin x$
- $\sec(90^\circ + x) = -x$
- $\cot(90^\circ + x) = -\tan x$

Numerator $= \sin x + x + \tan x$ Denominator $= -\sin x - x - \tan x = -(\sin x + x + \tan x)$

Therefore: $\frac{\sin x + x + \tan x}{-(\sin x + x + \tan x)} = -1 \neq -3$

Note: There appears to be an error in the problem statement or expected answer.

0.0.20 Q3(A).2 [3 marks]

Prove that: $\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{2}\right) = 45^\circ$

Solution: Using $\tan^{-1} A + \tan^{-1} B = \tan^{-1}\left(\frac{A+B}{1-AB}\right)$:

$\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{2}\right) = \tan^{-1}\left(\frac{\frac{1}{3}+\frac{1}{2}}{1-\frac{1}{3}\times\frac{1}{2}}\right)$

$= \tan^{-1}\left(\frac{\frac{5}{6}}{1-\frac{1}{6}}\right) = \tan^{-1}\left(\frac{\frac{5}{6}}{\frac{5}{6}}\right) = \tan^{-1}(1) = 45^\circ$

0.0.21 Q3(A).3 [3 marks]

Find out equation of the line whose X-intercept is 3 and Y-intercept is 2.

Solution: Using intercept form: $\frac{x}{a} + \frac{y}{b} = 1$

Where $a = 3$ (x-intercept) and $b = 2$ (y-intercept)

$\frac{x}{3} + \frac{y}{2} = 1$

Multiplying by 6: $2x + 3y = 6$

Q.3 (B) [8 marks]

Attempt any two

0.0.22 Q3(B).1 [4 marks]

Prove that: $\tan(70°) = \frac{\cos(25°)+\sin(25°)}{\cos(25°)-\sin(25°)}$

Solution: RHS $= \frac{\cos(25°)+\sin(25°)}{\cos(25°)-\sin(25°)}$
Dividing numerator and denominator by $\cos(25°)$:
$= \frac{1+\tan(25°)}{1-\tan(25°)}$
Using $\tan(45° +) = \frac{1+\tan}{1-\tan}$:
$= \tan(45° + 25°) = \tan(70°) =$ LHS

0.0.23 Q3(B).2 [4 marks]

Prove that: $\frac{\sin +\sin 2+\sin 3}{\cos +\cos 2+\cos 3} = \tan 2$

Solution: Using sum-to-product formulas:
Numerator: $\sin + \sin 3 + \sin 2 = 2 \sin 2 \cos + \sin 2 = \sin 2(2 \cos + 1)$
Denominator: $\cos + \cos 3 + \cos 2 = 2 \cos 2 \cos + \cos 2 = \cos 2(2 \cos + 1)$
Therefore: $\frac{\sin 2(2\cos +1)}{\cos 2(2\cos +1)} = \frac{\sin 2}{\cos 2} = \tan 2$

0.0.24 Q3(B).3 [4 marks]

If $\vec{a} = (1, 2, 3)$**,** $\vec{b} = (4, 0, 0)$ **and** $\vec{c} = (2, 0, 1)$ **find** $2\vec{a} + 3\vec{b} - 5\vec{c}$

Solution: $2\vec{a} = 2(1, 2, 3) = (2, 4, 6)$ $3\vec{b} = 3(4, 0, 0) = (12, 0, 0)$ $5\vec{c} = 5(2, 0, 1) = (10, 0, 5)$
$2\vec{a} + 3\vec{b} - 5\vec{c} = (2, 4, 6) + (12, 0, 0) - (10, 0, 5) = (2 + 12 - 10, 4 + 0 - 0, 6 + 0 - 5) = (4, 4, 1)$

Q.4 (A) [6 marks]

Attempt any two

0.0.25 Q4(A).1 [3 marks]

If the vectors $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 3\hat{k}$ **and** $\vec{b} = 2\hat{\imath} + m\hat{\jmath} - 4\hat{k}$ **are perpendicular, find m.**

Solution: For perpendicular vectors: $\vec{a} \cdot \vec{b} = 0$
$\vec{a} \cdot \vec{b} = (1)(2) + (-2)(m) + (3)(-4) = 2 - 2m - 12 = -10 - 2m$
Setting equal to zero: $-10 - 2m = 0$ $2m = -10$ $m = -5$

0.0.26 Q4(A).2 [3 marks]

Find the direction cosines and direction angles of the vector $\vec{a} = 5\hat{\imath} - 12\hat{k}$

Solution: $\vec{a} = 5\hat{\imath} + 0\hat{\jmath} - 12\hat{k}$
Magnitude: $|\vec{a}| = \sqrt{5^2 + 0^2 + (-12)^2} = \sqrt{25 + 144} = \sqrt{169} = 13$
Direction cosines:

- $l = \frac{5}{13}$
- $m = \frac{0}{13} = 0$
- $n = \frac{-12}{13}$

Direction angles:

- $= \cos^{-1}\left(\frac{5}{13}\right)$
- $= \cos^{-1}(0) = 90°$
- $= \cos^{-1}\left(\frac{-12}{13}\right)$

0.0.27 Q4(A).3 [3 marks]

Find out equation of the circle having center at $(2, -3)$ and radius 3.

Solution: Standard form: $(x-h)^2 + (y-k)^2 = r^2$

Where $(h, k) = (2, -3)$ and $r = 3$

$(x-2)^2 + (y+3)^2 = 9$

Expanding: $x^2 - 4x + 4 + y^2 + 6y + 9 = 9$ $x^2 + y^2 - 4x + 6y + 4 = 0$

Q.4 (B) [8 marks]

Attempt any two

0.0.28 Q4(B).1 [4 marks]

Show that the angle between vectors $\vec{a} = \hat{\imath} + 2\hat{\jmath}$ and $\vec{b} = \hat{\imath} + \hat{\jmath} + 3\hat{k}$ is $\sin^{-1}\sqrt{\frac{46}{55}}$

Solution: $\vec{a} \cdot \vec{b} = (1)(1) + (2)(1) + (0)(3) = 1 + 2 = 3$

$|\vec{a}| = \sqrt{1^2 + 2^2} = \sqrt{5}$ $|\vec{b}| = \sqrt{1^2 + 1^2 + 3^2} = \sqrt{11}$

$\cos\ = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}||\vec{b}|} = \frac{3}{\sqrt{5}\sqrt{11}} = \frac{3}{\sqrt{55}}$

$\sin^2\ = 1 - \cos^2\ = 1 - \frac{9}{55} = \frac{46}{55}$

Therefore: $\ = \sin^{-1}\sqrt{\frac{46}{55}}$

0.0.29 Q4(B).2 [4 marks]

Under effect of the forces $2\hat{\imath} + \hat{\jmath} + \hat{k}$ and $\hat{\imath} + 3\hat{\jmath} - \hat{k}$ a particle moves from the point $(1, 2, -3)$ to the point $(5, 3, 7)$. Find out work done.

Solution: Net force: $\vec{F} = (2\hat{\imath} + \hat{\jmath} + \hat{k}) + (\hat{\imath} + 3\hat{\jmath} - \hat{k}) = 3\hat{\imath} + 4\hat{\jmath}$

Displacement: $\vec{s} = (5, 3, 7) - (1, 2, -3) = (4, 1, 10)$

Work done: $W = \vec{F} \cdot \vec{s} = (3)(4) + (4)(1) + (0)(10) = 12 + 4 = 16$ units

0.0.30 Q4(B).3 [4 marks]

Evaluate: $\lim_{x\to 0} \frac{2^x - 5^x}{x}$

Solution: Using L'Hôpital's rule or the derivative definition:

$\lim_{x\to 0} \frac{2^x - 5^x}{x} = \lim_{x\to 0} \frac{2^x \ln 2 - 5^x \ln 5}{1}$

$= 2^0 \ln 2 - 5^0 \ln 5 = \ln 2 - \ln 5 = \ln\left(\frac{2}{5}\right)$

Q.5 (A) [6 marks]

Attempt any two

0.0.31 Q5(A).1 [3 marks]

Evaluate: $\lim_{x\to 0} \left(1 + \frac{3x}{7}\right)^{\frac{1}{x}}$

Solution: Let $y = \left(1 + \frac{3x}{7}\right)^{\frac{1}{x}}$

Taking natural log: $\ln y = \frac{1}{x} \ln\left(1 + \frac{3x}{7}\right)$

$\lim_{x\to 0} \ln y = \lim_{x\to 0} \frac{\ln\left(1 + \frac{3x}{7}\right)}{x}$

Using L'Hôpital's rule: $= \lim_{x\to 0} \frac{\frac{3/7}{1+\frac{3x}{7}}}{1} = \frac{3}{7}$

Therefore: $\lim_{x\to 0} y = e^{3/7}$

0.0.32 Q5(A).2 [3 marks]

Evaluate: $\lim_{x \to 3} \frac{x^2-5x+6}{x^2-9}$

Solution: Factoring numerator: $x^2 - 5x + 6 = (x - 2)(x - 3)$ Factoring denominator: $x^2 - 9 = (x - 3)(x + 3)$ $\lim_{x \to 3} \frac{x^2-5x+6}{x^2-9} = \lim_{x \to 3} \frac{(x-2)(x-3)}{(x-3)(x+3)} = \lim_{x \to 3} \frac{x-2}{x+3} = \frac{3-2}{3+3} = \frac{1}{6}$

0.0.33 Q5(A).3 [3 marks]

Evaluate: $\lim_{x \to 0} \frac{\sqrt{4+x}-2}{x}$

Solution: Rationalizing the numerator:

$\lim_{x \to 0} \frac{\sqrt{4+x}-2}{x} \times \frac{\sqrt{4+x}+2}{\sqrt{4+x}+2}$

$= \lim_{x \to 0} \frac{(4+x)-4}{x(\sqrt{4+x}+2)} = \lim_{x \to 0} \frac{x}{x(\sqrt{4+x}+2)} = \lim_{x \to 0} \frac{1}{\sqrt{4+x}+2} = \frac{1}{2+2} = \frac{1}{4}$

Q.5 (B) [8 marks]

Attempt any two

0.0.34 Q5(B).1 [4 marks]

Find out equation of the line passing through points $(1, 2)$ and $(2, 1)$.

Solution: Using two-point form: $\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$

$\frac{y-2}{1-2} = \frac{x-1}{2-1}$

$\frac{y-2}{-1} = \frac{x-1}{1}$

$y - 2 = -(x - 1) = -x + 1$

$x + y = 3$

0.0.35 Q5(B).2 [4 marks]

Find equation of the line that passes through $(-3, 2)$ and parallel to the line $x - 2y + 1 = 0$

Solution: The given line $x - 2y + 1 = 0$ has slope $m = \frac{1}{2}$

Since parallel lines have the same slope, required line has slope $m = \frac{1}{2}$

Using point-slope form: $y - y_1 = m(x - x_1)$

$y - 2 = \frac{1}{2}(x - (-3))$

$y - 2 = \frac{1}{2}(x + 3)$

$2y - 4 = x + 3$

$x - 2y + 7 = 0$

0.0.36 Q5(B).3 [4 marks]

Find out center and radius of the circle: $x^2 + y^2 + 6x - 4y - 3 = 0$

Solution: Completing the square:

$x^2 + 6x + y^2 - 4y = 3$

$(x^2 + 6x + 9) + (y^2 - 4y + 4) = 3 + 9 + 4$

$(x + 3)^2 + (y - 2)^2 = 16$

Center: $(-3, 2)$ **Radius**: $r = \sqrt{16} = 4$

Formula Cheat Sheet

0.0.37 Logarithms

- $\log_a 1 = 0$

- $\log_a a = 1$

- $\log_a(xy) = \log_a x + \log_a y$
- $\log_a \left(\frac{x}{y}\right) = \log_a x - \log_a y$

0.0.38 Trigonometry

- $\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$
- $\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$
- $\sin(180° - x) = \sin x$, $\cos(90° + x) = -\sin x$

0.0.39 Vectors

- $|\vec{a}| = \sqrt{a_1^2 + a_2^2 + a_3^2}$
- $\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos$
- For perpendicular vectors: $\vec{a} \cdot \vec{b} = 0$

0.0.40 Coordinate Geometry

- Two-point form: $\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$
- Circle: $(x-h)^2 + (y-k)^2 = r^2$
- Parallel lines have equal slopes

0.0.41 Limits

- $\lim_{x\to 0} \frac{\sin x}{x} = 1$
- $\lim_{x\to 0} \frac{e^x-1}{x} = 1$
- $\lim_{x\to \infty} \frac{ax+b}{cx+d} = \frac{a}{c}$

Problem-Solving Strategies

1. **Logarithms**: Use properties to simplify expressions
2. **Trigonometry**: Apply compound angle formulas and identities
3. **Vectors**: Remember dot and cross product properties

Common Mistakes to Avoid

0.0.42 Logarithms

- **Mistake**: Confusing $\log_a b$ with $\log_b a$
- **Solution**: Remember change of base: $\frac{1}{\log_a b} = \log_b a$

0.0.43 Trigonometry

- **Mistake**: Wrong angle conversions between degrees and radians
- **Solution**: Always use $180° = \pi$ radians for conversion

0.0.44 Vectors

- **Mistake**: Confusing dot product with cross product
- **Solution**: Dot product gives scalar, cross product gives vector

0.0.45 Limits

- **Mistake**: Direct substitution in indeterminate forms
- **Solution**: Use algebraic manipulation, L'Hôpital's rule, or standard limits

0.0.46 Determinants

- **Mistake**: Sign errors in expansion
- **Solution**: Follow the checkerboard pattern carefully

Exam Tips

0.0.47 Time Management

- **Q1 (14 marks)**: 20-25 minutes - Quick calculations
- **Q2-Q5**: 35-40 minutes each - Show all steps clearly

0.0.48 Strategy

1. **Read all questions first** - Choose easier OR options
2. **Start with Q1** - Build confidence with MCQs
3. **Show work clearly** - Partial credit is available
4. **Use standard formulas** - Don't derive unless asked

0.0.49 Key Points to Remember

- Always write the final answer clearly
- Use proper mathematical notation
- Draw diagrams where helpful
- Check units in physics-related problems (work, force)

0.0.50 Calculator Usage

- Scientific calculator allowed
- Use for complex arithmetic only
- Show the setup before calculating
- Round final answers appropriately

0.0.51 Common Formula Applications

Standard Limits (Memory aids)

```
lim(x\rightarrow0) sin(x)/x = 1         "Sine over x is one"
lim(x\rightarrow0) (e^x - 1)/x = 1      "e minus one over x is one"
lim(x\rightarrow0) (a^x - 1)/x = ln(a)  "General exponential form"
```

Trigonometric Identities (Quick Reference)

Mermaid Diagram (Code)

```
{Shaded}
{Highlighting}[]
graph LR
    A[sin^{2 + cos^{2} = 1] {-}{-}{} B[1 + tan^{2} = sec^{2}]}
    A {-{-}{} C[1 + cot^{2} = cosec^{2}]}
    D["sin(A)"] {-{-}{} E[sin A cos B  cos A sin B]}
    F["cos(A)"] {-{-}{} G[cos A cos B  sin A sin B]}
{Highlighting}
{Shaded}
```

Vector Operations (Step-by-step)

1. **Magnitude**: $|\vec{a}| = \sqrt{sum\,of\,squares}$
2. **Dot Product**: $\vec{a} \cdot \vec{b} = a_1b_1 + a_2b_2 + a_3b_3$
3. **Angle**: $\cos = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}||\vec{b}|}$

Circle Equations (Forms)

Form	Equation	When to Use
Standard	$(x-h)^2+(y-k)^2=r^2$	Given center and radius
General	$x^2+y^2+Dx+Ey+F=0$	Need to find center/radius
Complete Square	$(x+D/2)^2+(y+E/2)^2 = (D^2+E^2-4F)/4$	Converting general to standard

0.0.52 Problem-Specific Strategies

For Determinant Problems

1. Look for zeros to simplify expansion
2. Use row/column operations if allowed
3. Remember: if two rows/columns are proportional, determinant $= 0$

For Limit Problems

```
    Start with limit
          |
    Direct substitution?
      /        {}
    Yes         No (0/0, /, etc.)
     |            |
   Answer    Try factoring/
             rationalization
                  |
             Still indeterminate?
                  |
            L{Hôpitals Rule}
                  |
             Find answer
```

For Vector Problems

- **Step 1**: Write vectors in component form
- **Step 2**: Apply required operation (dot/cross product)
- **Step 3**: Simplify and find magnitude if needed
- **Step 4**: Check perpendicularity condition ($\vec{a}\cdot\vec{b}=0$)

For Coordinate Geometry

- **Line problems**: Identify what's given (points, slope, parallel/perpendicular)
- **Circle problems**: Identify center and radius from given information
- **Always** check your equation by substituting known points

0.0.53 Memory Techniques

Logarithm Properties (MNEMONIC: "PLUS")

- **P**roduct: $\log(ab)=\log a+\log b$
- **L**imit: $\log_a 1 = 0$
- **U**nity: $\log_a a = 1$

- **S**ubtraction: $\log(a/b)=\log a-\log b$

Trigonometric Values (30$^\circ, 45^\circ, 60^\circ$)

Angle	sin	cos	tan
30°	$1/2$	$\sqrt{3}/2$	$1/\sqrt{3}$
45°	$1/\sqrt{2}$	$1/\sqrt{2}$	1
60°	$\sqrt{3}/2$	$1/2$	$\sqrt{3}$

Memory aid: "1, 2, 3" under square roots for sin values ($30° to 60°$)

0.0.54 Final Review Checklist

Before submitting your paper:

- ☐ All questions attempted as required
- ☐ Final answers clearly marked
- ☐ Units included where applicable

- ☐ No arithmetic errors in simple calculations
- ☐ Proper mathematical notation used
- ☐ Diagrams labeled clearly (if drawn)

0.0.55 Quick Problem Solving Guide

If you're stuck on a problem:

1. **Read the problem again** - Often missed details become clear
2. **Try a different approach** - Multiple methods usually exist
3. **Work backwards** - Start from what you want to prove/find
4. **Use elimination** - In MCQs, eliminate obviously wrong options
5. **Move on and return** - Don't spend too much time on one problem

Last 15 minutes strategy:

- Focus on completing MCQs in Q1
- Check arithmetic in longer problems
- Ensure all final answers are clearly marked
- Review any skipped parts of questions

Remember: This exam tests fundamental concepts. Focus on understanding rather than memorizing, and always show your reasoning clearly for maximum partial credit.