

City University of Hong Kong
Department of Mathematics

MATHEMATICS COMBINED PLACEMENT TEST FOR MA1200 & MA1201

Sample Questions & Solutions

Section A

1. The general solution of the equation $\tan x = 1$ is
 - A. $x = n\pi + \frac{\pi}{4}, n \in \mathbf{Z}.$
 - B. $x = n\pi \pm \frac{\pi}{4}, n \in \mathbf{Z}.$
 - C. $x = n\pi + (-1)^n \frac{\pi}{4}, n \in \mathbf{Z}.$
 - D. $x = 2n\pi + \frac{\pi}{4}, n \in \mathbf{Z}.$

2. The graph of $(y - 2)^2 = 4 - x^2$ is
 - A. a parabola.
 - B. a circle.
 - C. a point.
 - D. a pair of straight lines.

3. What is the remainder when $1 - x + x^2 - \dots + x^8$ is divided by $x + 1$?
 - A. $-1.$
 - B. $1.$
 - C. $8.$
 - D. $9.$

4. Which of the following is an even function of x ?

A. $f(x) = \sin 2x$.

B. $f(x) = |x| \cos 3x$.

C. $f(x) = |x| \tan x$.

D. $f(x) = x^4 - 2x^2 + 1$.

5. $\frac{d^{13}}{dx^{13}}(\sin x) =$

A. $\sin x$.

B. $-\sin x$.

C. $\cos x$.

D. $-\cos x$.

6. Evaluate $\lim_{x \rightarrow 1} \frac{\log_e x}{x^2 - 1}$.

A. 0.

B. $\frac{1}{2}$.

C. 1.

D. -1.

7. Differentiate $\tan^{-1}\left(\frac{1+x^2}{1-x^2}\right)$ with respect to x .

A. $\tan x$.

B. $\frac{1}{1+x^2}$.

C. $\frac{x^2}{1+x^4}$.

D. $\frac{2x}{1+x^4}$.

8. Which of the following is true regarding the function $f(x) = 2x^3 + 3x^2 - 12x + 6$?

A. It has no local maximum point.

B. $x = 0$ is a point of inflexion.

C. It has a local maximum point at $x = 2$.

D. It has a local minimum point at $x = 1$.

Section B

9. $\int \frac{\cos \sqrt{x}}{\sqrt{x}} dx =$

A. $2 \sin \sqrt{x} + C .$

B. $-2 \sin \sqrt{x} + C .$

C. $-\frac{1}{2} \sin \sqrt{x} + C .$

D. $\frac{1}{2} \sin(2\sqrt{x}) + C .$

10. $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sin 2x \cos 6x dx =$

A. $-\frac{1}{4} .$

B. $0 .$

C. $\frac{1}{2} .$

D. $-\frac{1}{2} .$

11. $\int \frac{4x+42}{x^2+x-6} dx =$

A. $4 \log_e |x-2| + 41 \log_e |x+3| + C .$

B. $10 \log_e |x-2| - 6 \log_e |x+3| + C .$

C. $4 \log_e |x+6| - 6 \log_e |x-1| + C .$

D. $5 \log_e |x-2| - 3 \log_e |x+3| + C .$

12. Find the area of the region bounded by the line $x = 6 - y$ and the curve $x = y^2$.

A. $\frac{77}{6}$ units².

B. $\frac{95}{6}$ units².

C. $\frac{125}{6}$ units².

D. $\frac{139}{6}$ units².

13. If $A = \begin{pmatrix} 4 & -2 \\ -3 & 1 \end{pmatrix}$, then $A^2 - 5A =$

A. $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$.

B. $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$.

C. $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$.

D. $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$.

14. Evaluate the determinant $\begin{vmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{vmatrix}$.

A. 0.

B. 1.

C. 10.

D. 27.

15. Find the area of a triangle whose vertices are $(-1, -1, -1)$, $(-1, 0, 1)$ and $(-2, 0, 4)$.
- A. $2\sqrt{14}$ units².
- B. $\sqrt{14}$ units².
- C. $2\sqrt{7}$ units².
- D. $\frac{\sqrt{14}}{2}$ units².
16. If 1 , ω and ω^2 are the three distinct cube roots of unity, find the value of $(1 - \omega + \omega^2)(1 + \omega - 2\omega^2)$.
- A. 1.
- B. 2.
- C. 4.
- D. 6.

Solutions

1. A. $x = n\pi + \frac{\pi}{4}$, $n \in \mathbf{Z}$.
2. B. a circle.
3. D. 9.
4. B. $f(x) = |x| \cos 3x$.
5. C. $\cos x$.
6. B. $\frac{1}{2}$.
7. D. $\frac{2x}{1+x^4}$.
8. D. It has a local minimum point at $x = 1$.
9. A. $2 \sin \sqrt{x} + C$.
10. B. 0.
11. B. $10 \log_e |x-2| - 6 \log_e |x+3| + C$.
12. C. $\frac{125}{6}$ units².
13. C. $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$.
14. A. 0.
15. D. $\frac{\sqrt{14}}{2}$ units².
16. D. 6.