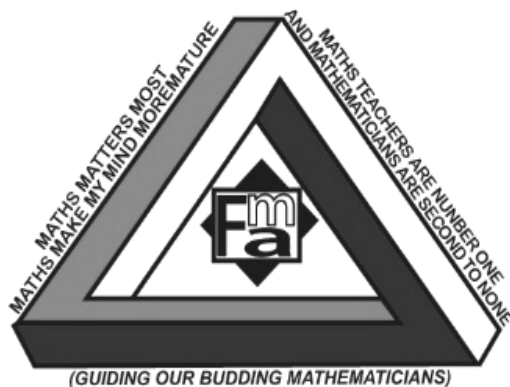


FIJI MATHEMATICS ASSOCIATION



FIJI MATHEMATICS COMPETITION (FMC) YEAR 13

Thursday 6th September 2018

Time Allowed: 1 Hour 15 minutes

Note:

Calculators are NOT permitted.

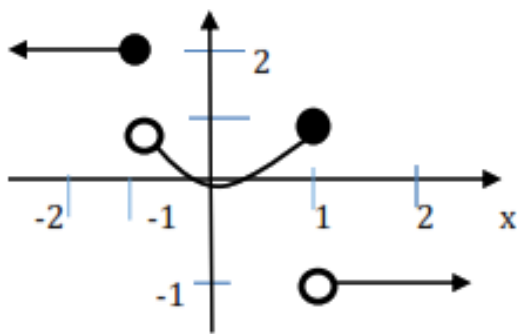
Diagrams are NOT drawn to scale.

Instructions:

1. Print your **Name** in the space provided and Shade the circle corresponding to your **Year** on the answer sheet.
2. Shade the circle corresponding to your answer with dark pencil on the answer sheet provided.
3. Multiple answers **will not be** accepted.

Year 13

Consider the graph of $f(x)$ to answer questions 1, 2 and 3.



1. Find $f(1)$

- A. 0 B. -1 C. 1 D. 2 E. does not exist

2. What is the value of $f'(1.5)$?

- A. 0 B. undefined C. -1 D. 1 E. 2

3. Find $\lim_{x \rightarrow 1^+} f(x)$

- A. 0 B. undefined C. -1 D. 1 E. 2

4. Evaluate 2.3×0.11

- A. 0.0253 B. 0.253 C. 2.53 D. 0.02311 E. 0.2311

5. Simplify $\sqrt[6]{729}$

- A. 1 B. 3 C. 9 D. 27 E. 81

6. Solve $\cos 2x = -\frac{1}{2}$ for $0 \leq x \leq 180^\circ$

- A. $x \in \{30^\circ, 150^\circ\}$ B. $x \in \{15^\circ, 30^\circ\}$ C. $y = x \in \{45^\circ, 135^\circ\}$
D. $x \in \{120^\circ, 150^\circ\}$ E. $x \in \{60^\circ, 120^\circ\}$

7. Find oblique asymptote of the rational function

$$f(x) = \frac{2x^2 + x - 6}{x - 1}$$

- A. $y = 2x - 1$ B. $y = 2x + 1$ C. $y = 2x$ D. $y = 2x + 3$ E. $y = 2$

8. If $z = 1 - 2i$, then $|z \cdot \bar{z}|^2$ simplified is

- A. 25 B. 5 C. 3 D. 9 E. 10

9. If $f(x) = x^2 - 3$ and $g(x) = \sqrt{x - 1}$, then the range of $f \circ g(x)$ is best given as

- A. $y \leq -3$ B. $y \geq -3$ C. $y \geq -1$
D. $y \leq -1$ E. $y \geq -4$

Year 13

10. Find $\lim_{x \rightarrow 0} \frac{e^{2x}-1}{e^x-1}$
- A. $\frac{1}{2}$ B. -1 C. 1 D. 0 E. 2
11. If $x = \cos \frac{\pi}{3} + i \sin \frac{\pi}{3}$ and $y = \frac{1}{2}(\cos \frac{\pi}{4} + i \sin \frac{\pi}{4})$, then $\frac{x}{y}$ is:
- A. $2 \operatorname{cis} \frac{\pi}{6}$ B. $2 \operatorname{cis} \frac{\pi}{12}$ C. $\frac{1}{2} \operatorname{cis} \frac{7\pi}{12}$ D. $\frac{1}{2} \operatorname{cis} \frac{\pi}{12}$ E. $2 \operatorname{cis} \frac{7\pi}{12}$
12. Given $\frac{2x+3}{x^2-x-6} = \frac{A}{x-3} + \frac{B}{x+2}$, find the product A.B.
- A. $\frac{6}{15}$ B. $\frac{3}{15}$ C. $\frac{9}{25}$ D. $-\frac{9}{5}$ E. $-\frac{1}{5}$
13. For the sequence $A_n = \frac{3n-1}{n+2}$, the sequence of partial sums is S_n . Find S_3
- A. 1.6 B. 5.35 C. 3 D. 1.96 E. 3.52
14. Which of the following is a root of the complex quadratic equation $z^2 - 2z + 5 = 0$
- A. $1 + i$ B. $1 - i$ C. $1 + 2i$ D. $2i$ E. $-5i$
15. Solve $3 \log_{\frac{1}{2}} 4 = 2x$
- A. -1.5 B. -2.5 C. -1 D. -3 E. $-\frac{2}{3}$
16. In how many different ways the letters of the word "LIMITS" can be rearranged?
- A. 360 B. 36 C. 48 D. 60 E. 120
17. For the geometric sequence $\langle 1, -\frac{1}{3} \rangle$ find sum of first four terms.
- A. $\frac{1}{27}$ B. $\frac{15}{27}$ C. $\frac{20}{27}$ D. $\frac{25}{27}$ E. $\frac{26}{27}$
18. The exact value of $\frac{\sin^2 30^\circ}{\cos^2 30^\circ}$ is:
- A. 1 B. 3 C. $\frac{\sqrt{3}}{2}$ D. $\frac{1}{3}$ E. $\frac{1}{\sqrt{3}}$
19. The argument of the complex number $z = 1 - i$ is:
- A. $\frac{-\pi}{6}$ B. $\frac{-\pi}{4}$ C. $\frac{\pi}{6}$ D. $\frac{\pi}{4}$ E. $\frac{-\pi}{2}$
20. What is $0.3333\dots$ (recurring) + $0.6363\dots$ (recurring)?
- A. $\frac{10}{11}$ B. $\frac{21}{11}$ C. $\frac{32}{33}$ D. 1 E. undefined
21. Evaluate $\int_0^{\frac{\pi}{2}} \sin 2x \, dx$
- A. -0.5 B. 0.5 C. -1 D. 1 E. 2

Year 13

22. A box with square base and open top has a surface area of 768cm^2 . The volume of the box is given by $V = 75x - \frac{1}{9}x^3$. What value of x (in cm) maximizes the volume?

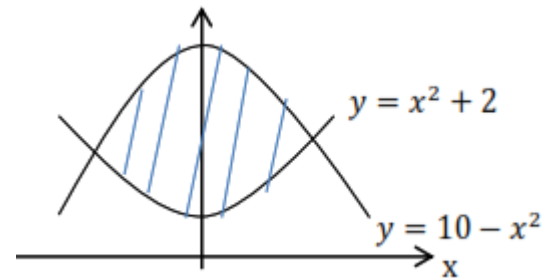
- A. 25 B. 15 C. 10 D. 7.5 E. 5

23. The cubic function $x^3 + 3x^2 - 10x - 24$ has three roots a, b, c . Find the value of $a+b+c$.

- A. -6 B. -3 C. -1 D. 6 E. 3

24. Which of the following integrals represents the shaded area below?

- A. $\int_{-2}^2 (2x^2 - 8)dx$ B. $\int_{-2}^2 (2x^2 - 12)dx$ C. $\int_{-2}^2 (8 - 2x^2)dx$
D. $\int_2^{10} (2x^2 - 6)dx$ E. $\int_2^{10} (6 - 2x^2)dx$



25. The coefficient of $1/a^7$ in the expansion of $(a^3 - \frac{1}{a^2})^6$ is:

- A. -6 B. -12 C. -24 D. -36 E. -72

26. The product of 3 consecutive prime numbers is 1001. What is the sum of the numbers?

- A. 10 B. 15 C. 31 D. 41 E. 60

27. 30. If $\sqrt{x^2 + 1} = 2$ then $x^4 + 2x^2 - 5$ equals

- A. -3 B. 10 C. 11 D. 16 E. 81

28. John takes 30 minutes to wash a car while Rohit takes 20 minutes to complete the same task. How long will they take(in mins) to wash the car together?

- A. 18 B. 15 C. 13 D. 12 E. 10

29. If $y = 3\sqrt[3]{\cos x}$ find $\frac{dy}{dx}$ $(\frac{d}{dx}(\cos x) = -\sin x)$

- A. $\sin x \sqrt[3]{\cos^2 x}$ B. $-\sin x \sqrt[3]{\cos^2 x}$ C. $\frac{\sin x}{\sqrt[3]{\cos^4 x}}$

- D. $\frac{-\sin x}{\sqrt[3]{\cos^2 x}}$ E. $\frac{\sqrt[3]{\cos^4 x}}{\sin x}$

30. What value of x will make the vectors $\begin{pmatrix} -2 \\ x-1 \\ x \end{pmatrix}$ and $\begin{pmatrix} 3 \\ 2 \\ -4 \end{pmatrix}$ orthogonal?

- A. -4 B. -3 C. -2 D. -1 E. 0