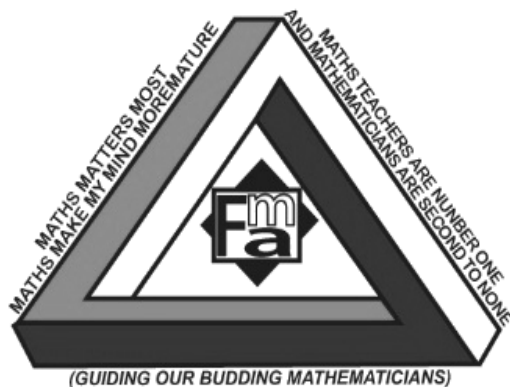


FIJI MATHEMATICS ASSOCIATION



FIJI MATHEMATICS COMPETITION (FMC) YEAR 12

Wednesday 6th September 2017

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 12

1. A set $S = \{0, 1, 2, 3, 4\}$ is given under the operation 'multiplication modulo 5'.

The inverse of 3, (3^{-1}) is:

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

x	0	1	2	3	4
0	0	0	0	0	0
1	0	1	2	3	4
2	0	2	4	1	3
3	0	3	1	4	2
4	0	4	3	2	1

2. When simplified $\frac{\sqrt{3}+2}{\sqrt{3}-2}$ is equivalent to

- A. $7 + 4\sqrt{3}$ B. $7 - 4\sqrt{3}$ C. $-7 + 4\sqrt{3}$ D. $5 + 2\sqrt{3}$ E. $-7 - 4\sqrt{3}$

3. Which of the following best represents the correct value, when solved for x in $2^{3x} = 8^{2x+1}$.

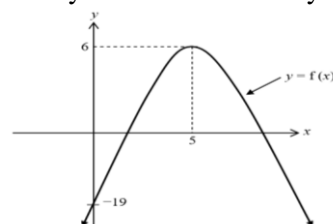
- A. 3 B. -2 C. 2 D. 1 E. -1

4. If $x = \log 3$ and $y = \log 21$, then an expression for $\log 7$ in terms of x and y is .

- A. $\frac{y}{x}$ B. $\frac{y-x}{2}$ C. $x + y$ D. $x - y$ E. $y - x$

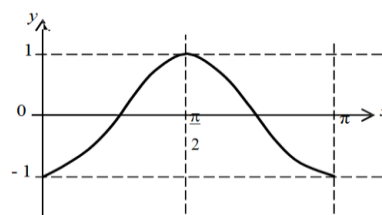
5. The diagram given on right shows the graph of $y = f(x)$. The equation of the graph of f (x) is.

- A. $f(x) = 6 - (x - 5)^2$ B. $f(x) = 6 - (x - 5)^2 + 6$
 C. $f(x) = (x + 6)^2 + 5$ D. $f(x) = 5 - (x + 6)^2$
 E. $f(x) = (x - 5)^2 - 6$



6. The equation of the graph shown on right where $0 \leq x \leq \pi$ is

- A. $y = -\cos x$
 B. $y = \cos(x + \pi)$
 C. $y = \sin(x - \pi)$
 D. $y = -\cos 2x$
 E. $y = -\sin 2x$



7. The formula $C = \frac{5}{9}(F - 32)$ is used to convert temperature from Fahrenheit to degrees Celsius. If $C = 40^\circ$, Calculate F.

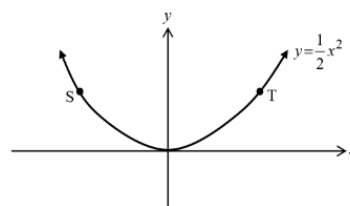
- A. 102°C B. 122°F C. 104°C D. 122°C E. 104°F

8. The solution set for $3 - 2x - x^2 \leq 0$ is given by

- A. $x \geq -3$ or $x \geq 1$ B. $x \leq -3$ or $x \leq 1$ C. $x \leq 3$ or $x \geq 1$ D. $x \leq -3$ or $x \geq -1$ E. $x \leq -3$ or $x \geq 1$

9. The points S and T on the curve $y = \frac{1}{2}x^2$ shown below, both have a y-coordinate of 8. The distance between points S and T, in units, is

- A. 16 B. 8 C. 64
 D. 4 E. 32



10. A bag contained 9 balls of the same size of which 3 were red, 4 blue and 2 white. A ball is picked at random, its colour noted and a second ball is picked **without replacing** the first ball. What is the probability that the balls picked were of the same colour?

- A. 0.72 B. 0.42 C. 0.56 D. 1 E. 0.28

11. The graph of $y = f(-x)$ is obtained by reflecting the graph of $y = f(x)$ in the

- A. y-axis B. x-axis C. Line $y = x$ D. line $y = -x$ E. line $y = 2x$

12. In an experiment, three students were asked whether they read daily newspaper or not. What is the probability that all three students say 'yes'.

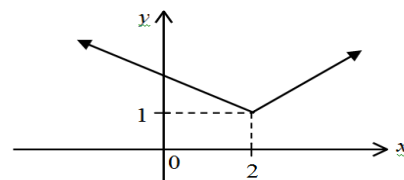
- A. $\frac{7}{8}$ B. $\frac{3}{8}$ C. $\frac{1}{8}$ D. $\frac{5}{8}$ E. $\frac{6}{8}$

Year 12

13. The graph of the function $f(x) = |x - 2| + 1$ is given below.

The range of $f(x) = |x - 2| + 1$ is

- A. $x \in \mathbb{R}$ B. $y \in \mathbb{R}$ C. $x \geq 2, x \in \mathbb{R}$
D. $y \geq 1, y \in \mathbb{R}$ E. $y \geq 2, y \in \mathbb{R}$



14. If A is an obtuse angle ($90^\circ < A < 180^\circ$), and $\sin A = \frac{3}{4}$, calculate the exact value of $\cos A$.

- A. $\frac{\sqrt{7}}{4}$ B. $\frac{3}{5}$ C. $\frac{-4}{\sqrt{7}}$ D. $\frac{4}{5}$ E. $\frac{-\sqrt{7}}{4}$

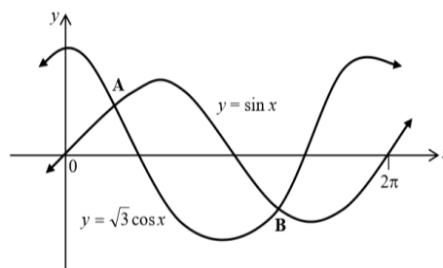
15. The matrix transformation that represents shear parallel to y -axis is

- A. $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ B. $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ C. $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$ D. $\begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix}$ E. $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$

16. The diagram below shows the graphs of $y = \cos \sqrt{3}x$ and $y = \sin x$. Points A and B are points of intersection of the two graphs.

Given that $\frac{\sin \theta}{\cos \theta} = \tan \theta$, find the x -coordinate of point A.

- A. $x = \frac{\pi}{4}$ B. $x = \frac{\pi}{2}$ C. $x = \frac{2\pi}{3}$
D. $x = \frac{4\pi}{3}$ E. $x = \frac{\pi}{3}$



17. The pendulum of a clock is slowing down. It usually swings through an angle of 20° but now decreases by 10% of the previous angle with each swing. The angles swung by the pendulum in successive swings form a geometric sequence. Given that the first swing had an angle of 20° , then the total angle that the pendulum swings through before it comes to rest is.

- A. 15° B. 130° C. 145° D. 2000° E. 200°

18. In a Mathematics competition each correct answer gains 5 marks. However, 1 mark is deducted for each incorrect answer. Jacob answered 30 questions for a total of 78 marks. The number of correct questions Jacob answered is.

- A. 12 correct B. 18 correct C. 20 correct D. 24 correct E. 28 correct

19. The image of point P ($m, -3$) under transformation by matrix $\begin{bmatrix} 1 & 2 \\ 3 & n \end{bmatrix}$ is Q ($-2, 3$). Find the values of m and n .

- A. $m = 4, n = 3$ B. $m = -4, n = -3$ C. $m = 4, n = -3$ D. $m = -4, n = 3$ E. $m = 3, n = 4$

20. A rocket launcher fires rocket from a site at ground level. The height (in metres) of the rocket above ground level, t seconds after it is fired is given by the formula $h = 120t - 5t^2$. Calculate the maximum height reached by the rocket.

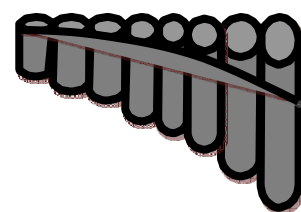
- A. 576m B. 600m C. 24m D. 720m E. 5760m

21. A polynomial is given as $g(x) = x^3 + 2x^2 + kx + m$. When $g(x)$ is divided by $(x+1)$ the remainder is 3 and when $g(x)$ is divided by $(x-1)$ the remainder is -1. The values of k and m is

- A. $m = 1, k = 3$ B. $m = -1, k = 3$ C. $m = 1, k = -3$ D. $m = -1, k = 2$ E. $m = -1, k = -3$

22. A 194 centimetres long bamboo stick is to be cut into eight pieces to make an "eight note bamboo pan flute" as shown. Each piece is 2.5 centimetres longer than the previous one. The length of the shortest piece will be:

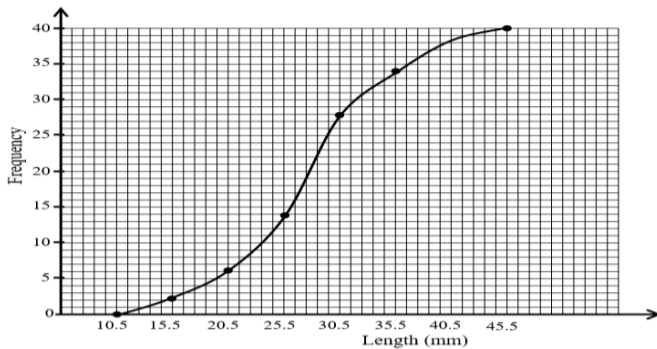
- A. 5cm B. 5.5 cm C. 14.5 cm
D. 15.5 cm E. 62.6 cm



Year 12

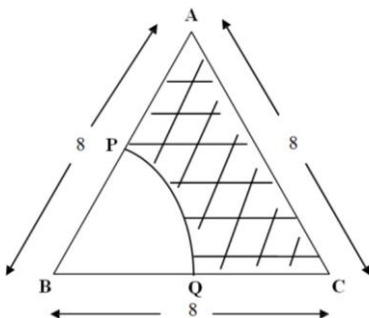
23. What is the most general condition that ensures that the sum to infinity exists for the sequence $2, 2x, 2x^2, 2x^3$?
- A. $0 < a < 1$ B. $0 < x < 1$ C. $-1 < a < 1$ D. $-1 < x < 1$ E. $-1 < x < 0$
24. Two sets of data are shown below:
 Set A = $\{a, b, c, d\}$ and Set B = $\{a + 2, b + 2, c + 2, d + 2\}$
 The mean and standard deviation of Set A are given as \bar{x} and s respectively. Which of the following best describes the mean and standard deviation of the data in Set B?
- A. \bar{x} and s B. \bar{x} and $s + 2$ C. $\bar{x} + 2$ and s D. $\bar{x} + 2$ and $s + 2$ E. $\bar{x} + 2$ and $2s$
25. $\int_0^k 3\sqrt{x} \, dx = 54$ when solved, the value of k is
- A. 18 B. 27 C. 12 D. 324 E. 9

26. A Sample of leaves was collected from a flower garden and the length of the leaves was measured. The graph given below shows the result.



The inter quartile range is

- A. 8.5
 B. 23.5
 C. 32
 D. 20
 E. 10
27. Line q is the tangent to a circle at point A $(2\sqrt{3}, 2)$. Point O is the centre of the circle.
- The size of the angle marked θ is.
- A. 45° B. 30°
 C. 90° D. 60°
 E. 120°
28. The rate of rainfall per day, measured in centimeters, x days after the beginning of the year is $0.00002(6511 + 366x - x^2)$. The total rainfall for the first 180 days of the year was:
- A. 6 cm B. 79.98 cm C. 103.14 cm D. 132 cm E. 180 cm
29. In the diagram given below, P is the midpoint of AB and Q is the midpoint of BC.



The length of the arc PQ is.

- A. 6.93 units
 B. 27.71 units
 C. 19.34 units
 D. 8.38 units
 E. 4.19 units
30. The $\lim_{x \rightarrow -2} \frac{16 - 4x^2}{x + 2}$ is
- A. 0 B. 8 C. Undefined D. 12 E. 16