



TEST FOR MATHEMATICS  
FOR UNIVERSITY  
ADMISSION (TMUA)  
MOCK TEST 4 QUESTIONS



## SECTION 1

1. What is the differential of  $x^x$ ?

- A.  $x * x^{x-1}$
- B.  $x^x \ln x$
- C.  $x^x \ln(x)^2$
- D.  $x^x (\ln(x) + 1)$
- E.  $x^x (\ln(x) + x)$

2. How many ways can you rearrange the word *pepper*?

- A. 30
- B. 120
- C. 720
- D. 60
- E. 80

3. The 6<sup>th</sup> term of an arithmetic sequence is equal to the 8<sup>th</sup>. What is the ratio of the first term and the common difference?

- A. -11
- B. -7
- C. -13
- D. -24
- E. -3

4. What is the value of  $x$  if  $\frac{2^{(25^x-5)}}{4^{(5^x)}} = \frac{1}{4}$ ?

- A.  $\log_5 7$
- B.  $\log_5 3$
- C.  $\log_5 2$
- D. 0
- E. 5

5. To  $f(x) = x^3$  apply the following transformations:

1. Translation 3 units in the x-axis
2. Reflection in the y-axis
3. Stretch 2 units in the y-axis
4. Reflection in the x-axis

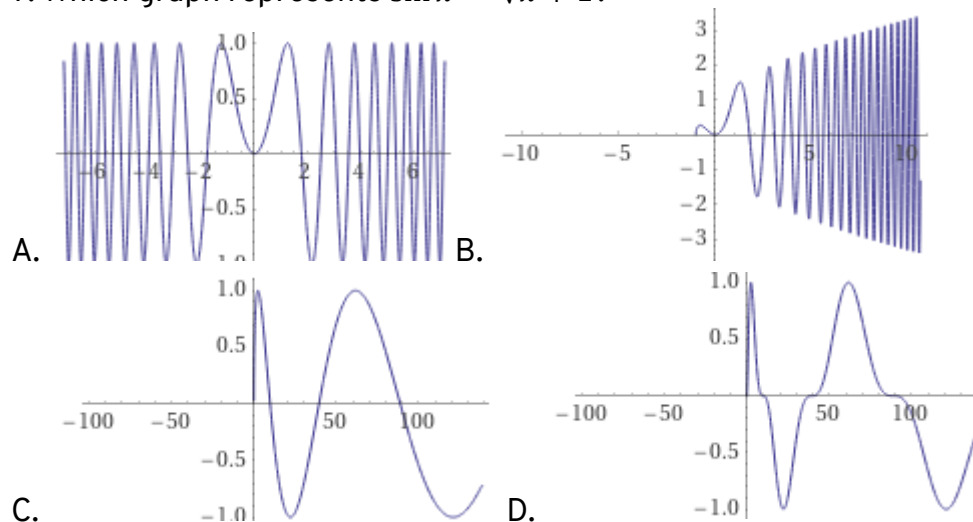
What is the resulting function?

- A.  $2(x + 3)^3$
- B.  $2(x - 3)^3$
- C.  $(2x + 3)^3$
- D.  $(2x + 6)^3$
- E.  $-2(x - 3)^3$

6. Let  $f(n + 1) = (1 - \sqrt{f(n)})^2$ ,  $f(n) \geq 1$ . What is  $f(n + 2)$ ?

- A.  $f(x)$
- B.  $2 - \sqrt{f(n)}$
- C.  $(1 - \sqrt{1 - f(n)})^2$
- D.  $(2 + \sqrt{f(n)})^2$
- E.  $(2 - f(n))^2$

7. Which graph represents  $\sin x^2 * \sqrt{x+1}$ ?



8. Consider the following statements:

1. Those who like Computer Science like Maths
2. Those who like Engineering like Physics
3. Those who do not like Physics do not like Maths

Which of the following are necessary consequences of the above?

1. Those who like Engineering like Maths
2. Those who like Computer Science like Physics
3. Those who like Maths do not like Engineering
4. Those who like Engineering do not like Computer Science
5. Those who like Computer Science like Engineering

- A. Only 2 and 3
- B. Only 1 and 4
- C. Only 4 and 5
- D. Only 1, 3 and 5
- E. Only 2

9. A box contains 3 coins, 2 fair and one two-headed. If I toss a random coin and I get heads, what is the probability I choose the two headed coin?

- A.  $\frac{2}{3}$
- B.  $\frac{1}{3}$
- C.  $\frac{1}{2}$
- D.  $\frac{3}{4}$
- E.  $\frac{1}{4}$

10. The quadratic  $f$  passes through the point  $(2, -9)$  and has a turning point at  $(-2, -25)$ . Find an expression for  $f$ .

- A.  $-x^2 + 6x - 18$
- B.  $x^2 + 3x - 19$
- C.  $-x^2 + 5x - 15$
- D.  $x^2 + 4x - 21$
- E.  $x^2 - 2x - 27$

11. Find the coefficient of  $x$  in the expression  $(1 + x) + (1 + x)^2 + (1 + x)^3 + (1 + x)^4 + \dots + (1 + x)^7$

- A. 36
- B. 60
- C. 28
- D. 24
- E. 21

12. How many solutions does  $\log_{(x-1)^2}(x^2 + x + 1) = 2$  have?

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

13. How many ways can you form a correct bracketing with 8 brackets (e.g: “()()()()”)?

- A. 24
- B. 4
- C. 128
- D. 16
- E. 14

14. 5 coins are thrown. What is the probability of getting two of the same in a row?

- A.  $\frac{31}{32}$
- B.  $\frac{7}{8}$
- C.  $\frac{15}{16}$
- D.  $\frac{1}{16}$
- E.  $\frac{13}{25}$

15. Given 5 straight unique lines on a plane, what is the minimum and maximum areas they leave behind?

- A. (10, 25)
- B. (10, 15)
- C. (6, 15)
- D. (5, 24)
- E. (6, 24)

16. What is the shortest distance between  $(x - 2)^2 + (y + 3)^2 = 5$  and  $(x + 3)^2 + (y - 9)^2 = 4$ ?

- A.  $3\sqrt{5}$
- B.  $11 - \sqrt{5}$
- C.  $7 - 2\sqrt{5}$
- D.  $13 - \sqrt{5}$
- E.  $7 - \sqrt{5}$

17. What is the differential of  $x^{x \ln x}$ ?

- A.  $x^{x \ln x} (\ln x + x)$
- B.  $x^{x \ln x} \ln x (\ln x + 2)$
- C.  $x^{x \ln x} x \ln x$
- D.  $x^{x \ln x} \ln x^2$
- E.  $x^{x \ln x}$

18. What is the value of  $\sqrt{28 - 6\sqrt{3}} + \sqrt{9 - 4\sqrt{2}}$ ?

- A.  $3\sqrt{3} + 2\sqrt{2} - 2$
- B.  $5\sqrt{3} + 3\sqrt{2}$
- C.  $2\sqrt{3} + 6\sqrt{2} - 3$
- D.  $2\sqrt{3} + 7\sqrt{2}$
- E.  $3\sqrt{3} + 2\sqrt{2} - 1$

19. Let  $f(x) = (x - 2)(x - p)$ . Find the set of values of  $p$  such that  $f$  is never less than -4.

- A.  $-2 \leq p \leq 4$
- B.  $3 \leq p \leq 8$
- C.  $-2 \leq p \leq 6$
- D.  $-4 \leq p \leq 3$
- E.  $-1 \leq p \leq 6$

20. How many solutions does  $\sin 2x \cos 3x$  have? ( $0 \leq x \leq 2\pi$ )

- A. 5
- B. 7
- C. 3
- D. 11
- E. 9

END OF SECTION 1



## SECTION 2

1. What is the differential of  $y = \frac{x}{x + \frac{x}{x + \dots}}$  assuming  $x > 0$ ?

- A.  $\frac{1-x^2}{x+2y}$
- B.  $\frac{1-y}{x+2y}$
- C.  $\frac{1-xy}{x+2y}$
- D.  $\frac{1-y}{x+2y}$
- E.  $\frac{1-x}{x+2y}$

2. There is a bag with 30 balls 14 of them green and the rest blue. What are the odds of selecting 10 balls of the same colour from a random sample?

- A.  $\frac{17}{4321}$
- B.  $\frac{1}{2234}$
- C.  $\frac{3}{245}$
- D.  $\frac{25}{5739}$
- E.  $\frac{1}{3335}$

3. What is the solution to x and y of the following system of equations?

$$x^2 - y^2 = 1$$

$$x^2 + y^2 = 4$$

$$y = kx + c \quad k, c > 0$$

A.  $(-\sqrt{\frac{5}{2}}, \sqrt{\frac{3}{2}})$

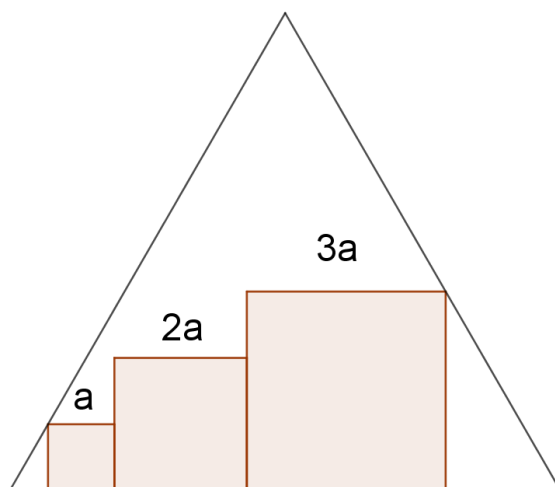
B.  $(\sqrt{\frac{3}{2}}, \sqrt{\frac{5}{2}})$

C.  $(\sqrt{\frac{2}{3}}, -\sqrt{\frac{5}{2}})$

D. There are no solutions

E. There are multiple solutions

4. What is the value of a? (The triangle is equilateral with size 1)



A.  $\frac{9-2\sqrt{3}}{46}$

B.  $\frac{7-2\sqrt{5}}{35}$

C.  $\frac{11-4\sqrt{3}}{46}$

D.  $\frac{7-3\sqrt{5}}{32}$

E.  $\frac{8-7\sqrt{3}}{24}$

5. The first term in a geometric sequence is  $5\sqrt{3}$  and the 4<sup>th</sup> is  $\frac{3}{10}$ . What is the sum to infinity?

- A.  $\frac{27\sqrt{3}}{11}$
- B.  $\frac{15\sqrt{5}}{7}$
- C. It can be multiple values
- D.  $\frac{27\sqrt{5}}{25}$
- E.  $\frac{50\sqrt{3}}{7}$

6. Find the coefficient of  $x^4$  in the expansion  $(x^5 - \frac{1}{x^3})^{12}$

- A. 792
- B. 624
- C. 786
- D. 445
- E. 354

7. The sum to infinity of a geometric sequence is 2 while the sum to infinity of the squares of the same sequence is 8. What is the sum to infinity of the sequence of cubes?

- A.  $\frac{3\sqrt{3}}{7}$
- B.  $\frac{13}{2\sqrt{2}}$
- C.  $\frac{18}{7}$
- D.  $\frac{22}{9}$
- E.  $\sqrt{5}$

8. Let  $f(x) = -x^2 + 2$  and let  $x_0 = \frac{\pi}{4}, x_{n+1} = f(x_n)$ . What is the value of  $x_\infty$ ?

- A.  $\frac{\pi^2}{6}$
- B. 1
- C.  $\tan\left(\frac{\pi}{4}\right)$
- D. 0
- E. The series does not converge

9. A student comes up with the following proof

$$\begin{aligned} -20 &= -20 \\ 16 - 36 &= 25 - 45 \\ 4^2 - 9 \times 4 &= 5^2 - 9 \times 5 \\ 4^2 - 9 \times 4 + \frac{81}{4} &= 5^2 - 9 \times 5 + \frac{81}{4} \\ \left(4 - \frac{9}{2}\right)^2 &= \left(5 - \frac{9}{2}\right)^2 \\ 4 &= 5 \end{aligned}$$

- A. There is a mistake in step IV only
- B. There is a mistake in step II and step IV
- C. There is a mistake in step IV and step V
- D. There is a mistake in step V only
- E. There are no mistakes

10. What is the maximum value  $\sin x \cos x$  can produce?

- A.  $\sqrt{3}$
- B.  $\frac{\sqrt{2}}{2}$
- C.  $\frac{\sqrt{3}}{2}$
- D.  $\frac{1}{2}$
- E. 1

11. Find what interval the function  $(\cos x - \sin x)(\tan 2x - \sqrt{3})$  is strictly positive ( $0 \leq x \leq \pi$ )

- A.  $(\frac{1}{6}\pi, \frac{1}{4}\pi) \cup (\frac{2}{3}\pi, \frac{3}{4}\pi)$
- B.  $(\frac{1}{6}\pi, \frac{1}{4}\pi) \cup (\frac{3}{4}\pi, \pi)$
- C.  $(\frac{1}{6}\pi, \frac{2}{3}\pi) \cup (\frac{4}{5}\pi, \pi)$
- D.  $(\frac{1}{6}\pi, \frac{2}{3}\pi) \cup (\frac{3}{4}\pi, \pi)$
- E.  $(0, \pi)$

12. What is the probability that  $x^2$  has remainder 4 when divided by 7? ( $x \leq 100$ )

- A.  $\frac{7}{10}$
- B.  $\frac{3}{10}$
- C.  $\frac{1}{3}$
- D.  $\frac{2}{5}$
- E.  $\frac{1}{7}$

13. Which value of  $n$  and  $m$  make the following fraction a whole number?

$$\frac{10^{n+2m} 6^{n-m} 15^{n+3m} 4^{2n}}{12^{3m} 8^{n+m} 20^{n-2m}}$$

- A.  $5n \geq 3m$
- B.  $n \geq 3m$
- C.  $2n \geq 5m$
- D.  $2n \geq 3m$  and  $3n \geq 5$
- E.  $n \geq m$

14. How many 0s does  $143!$  have?

- A. 26
- B. 32
- C. 45
- D. 34
- E. 62

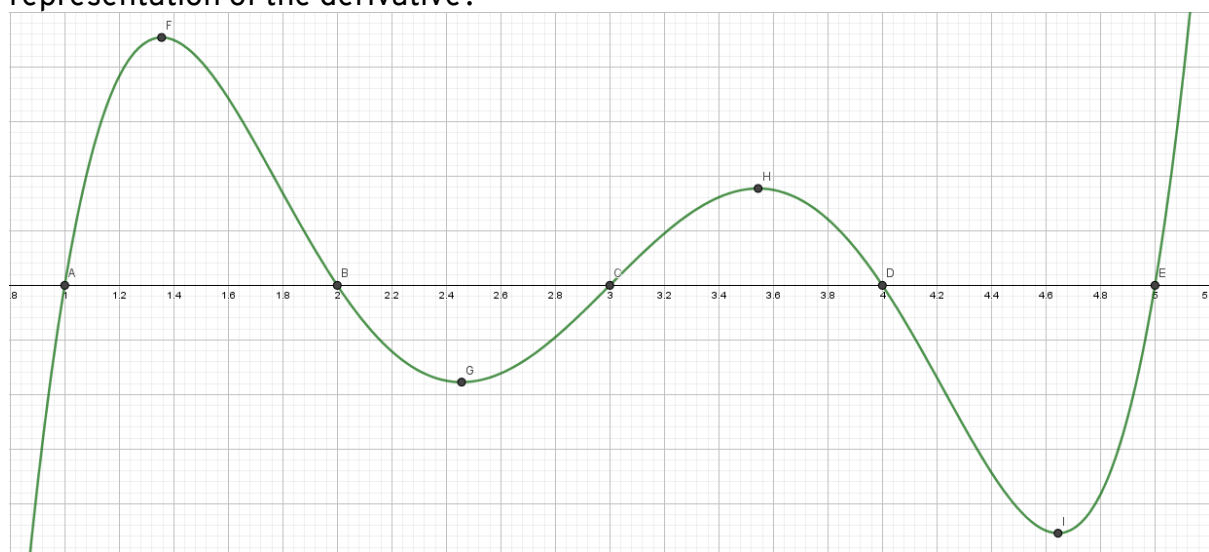
15. This question has ONLY one correct answer

- A. If  $f(x) > 0$  then  $x > 0$
- B.  $f(x) > 0$  if and only if  $x > 0$
- C. If  $f(x) > 0$  then  $x \in (3,7)$
- D.  $f(x) > 0$  if and only if  $x \in (3,7)$
- E. All of them are correct

16. Let  $f^{n+1}(x) = \frac{d}{dx} f^n(x)$  and  $f^1(x) = e^{(x^2)}$ . What is  $f^5$ ?

- A.  $4e^{(x^2)}(4x^4 + 12x^2 + 3)$
- B.  $4e^{(x^2)}(2x^4 + 9x^2 + 3)$
- C.  $4e^{(x^2)}(5x^4 + 8x^2 + 3)$
- D.  $4e^{(x^2)}(4x^4 + 8x^2 + 3x)$
- E.  $4e^{(x^2)}(3x^4 + 7x^2 + 2)$

17. Which of the following represent local minima of the function  $f$  given this representation of the derivative?



- A. G and I
- B. F and H
- C. A, C and E
- D. B and D
- E. C only

18. What is the indefinite integral of  $\frac{\ln \sqrt{x+1}}{\sqrt{x+1}}$ ?

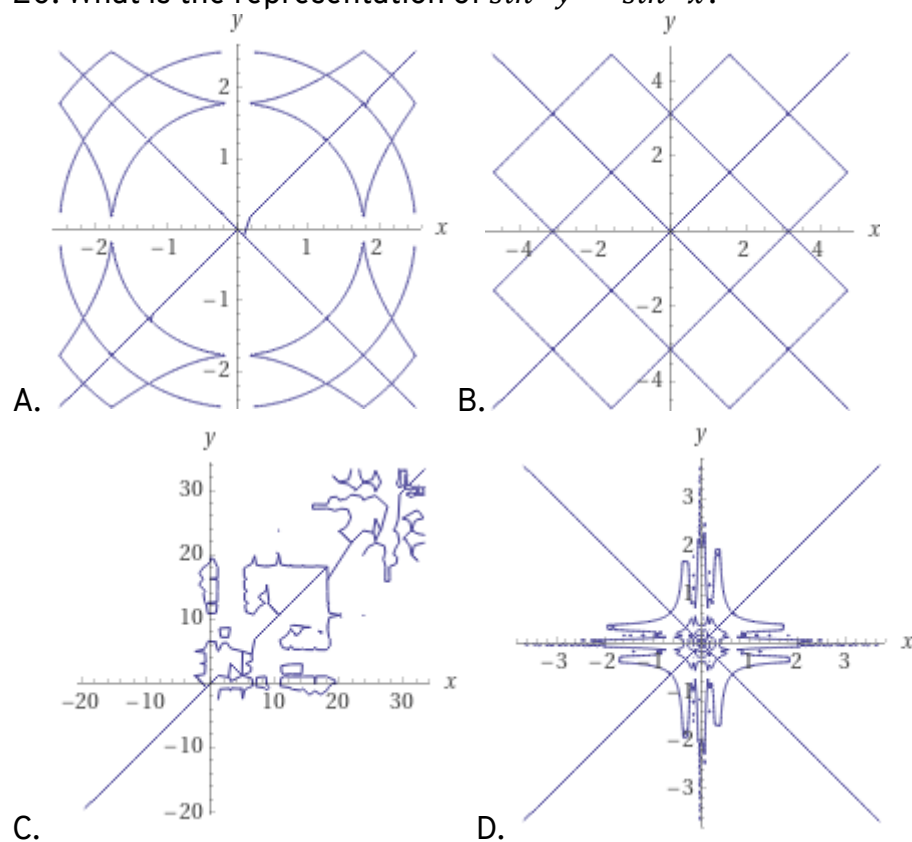
- A.  $\sqrt{x+1}(\ln(x+1) - 2)$
- B.  $(x+1)(\ln(\sqrt{x+1}) - 2)$
- C.  $\frac{(\ln(x+1)-2)}{\sqrt{x+1}}$
- D.  $2\sqrt{x+1}(\ln(x+1) - 1)$
- E.  $\sqrt{x+1}(\ln(\sqrt{x+1}) - 2)$

19.  $2^x - 1$  is prime then  $x$  is a prime. Which of the following is a counter example to this?

- A. 127
- B. 255
- C. 2047
- D. 63
- E. None of the above



20. What is the representation of  $\sin^2 y = \sin^2 x$ ?



END OF SECTION 2

