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TMUA MOCK PAPER TWO

75 Minutes

There are 20 questions on this TMUA Mock Paper Two, created by the boffins at Gresty Academy to mirror the style and difficulty level of past TMUA 'Paper Two' exams and provide more practice for our TMUA students. In our very subjective opinion, this mock paper is slightly harder than previous TMUA Paper Two exams, so don't be disillusioned if your score is lower than expected - good luck!!

Instructions: For each question, choose the one answer you consider correct - there are no penalties for incorrect responses, only marks for correct answers, so you should attempt all 20 questions. Each question is worth one mark. Calculators and dictionaries are NOT permitted and there is no formulae booklet allowed for this test.

Video answers to each question can be found at

https://www.grestyacademy.com/tmua/tmua-revision-help/

where there is also an abundance of completely free TMUA revision resources.

Important Note: This TMUA mock paper is intended to be a useful student resource to provide extra TMUA style practice and revision only - it is not endorsed by TMUA or TMUA test providers, neither is Gresty Academy affiliated in any way with TMUA or TMUA test providers. If anybody finds any errors in this paper, please let us know by emailing us at contact@grestyacademy.com and we will correct them.

Q1. For integers a and b , if

$$a^{(\sqrt{3}+4)} = 5^{(b+2\sqrt{3})}$$

then $a + b =$

A. 33

B. 34

C. 35

D. 36

E. 37

Q2. Which of the following circles is a counterexample to the statement

If a circle has radius greater than 5 then it crosses at least one of the x or y axes

A. $x^2 + y^2 = 36$

B. $(x - 10)^2 + (y - 10)^2 = 25$

C. $(x - 8)^2 + (y + 10)^2 = 49$

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

E. $(x + 7)^2 + (y - 2)^2 = 36$

Q3. In logic, how many of the following statements are *necessary* for $x > 2$ to be true?

- $|x| > 2$
- $|x| > 2$ and $x > 0$
- $x > 0$
- $|x| = 3$
- $|x| = 3$ and $x > 0$
- $|x| = 3$ or $x > 0$

A. 1

B. 2

C. 3

D. 4

E. 5

Q4. The number of real solutions to the equation

$$x^2 - ln(x) - 4 = 0$$

is

[Note: $ln(x)\ is\ log_e x$]

A. 0

B. 1

C. 2

D. 3

E. 4

Q5. The domain of the function

$$f(x) = log(x(x + 1)(x + 2)(x + 3))$$

is

A. $(-\infty, 0] \cup [1, 2] \cup [3, \infty)$

B. $(0, \infty)$

C. $(-\infty, -3] \cup [-2, -1] \cup [0, \infty)$

D. $(-\infty, -3) \cup (-2, -1) \cup (0, \infty)$

Q6. Which of the following functional equations does NOT represent reflective symmetry about the line $x = a$?

A. $f(a + x) = f(a - x)$

B. $f(2a + x) = f(- x)$

C. $f(2a - x) = f(x)$

D. $f(x - a) = f(- x + a)$

E. $f(p + x) = f(q - x)$ where $p + q = 2a$

Q7.

$$1000^2 - 999^2 + 998^2 - 997^2 + \ldots.$$
$$\ldots. + 4^2 - 3^2 + 2^2 - 1^2 =$$

A. $999,999$

B. $1,000,000$

C. $1,001,000$

D. $500,500$

Q8. The result $21 = 3 \times 7$ can be used as a counterexample to how many of the following statements involving an integer p ?

- $p + 1$ is always a multiple of 5 when p is even
- when p is even, p^2 is always a multiple of 5
- if p is a multiple of 3, it is also a multiple of 5
- when p is prime, it is never a multiple of 7
- when p is not prime it is always a product of 2 primes

A. 0

B. 1

C. 2

D. 3

E. 4

Q9. In logic, how many of the following statements are both *necessary* and *sufficient* for the conclusion $y > 4$?

- $y^2 > 16$
- $y^3 > 64$
- $y > 10$
- $y > 0$
- $5 < y < 6$

A. 0

B. 1

C. 2

D. 3

E. 4

Q10. Given that the sum of two positive real numbers x and y is 15, what is the maximum possible value of xy^2 ?

A. 497.5

B. 500

C. 502.5

D. 505

E. 507.5

Q11. Given that α and β are roots of

$$4x^2 + 7x - 3 = 0$$

then $\frac{2}{\alpha-1}$ and $\frac{2}{\beta-1}$

are roots of

A. $4x^2 + 15x + 8 = 0$

B. $4x^2 - 15x + 8 = 0$

C. $4x^2 + 15x - 8 = 0$

D. $4x^2 - 15x - 8 = 0$

Q12. How many of the following statements are *necessary* for

$$\int_{1}^{3} f(x)\,dx = 0$$

to hold true?

- $f(x) < 0$ for some $x \in [1, 3]$
- $f(x) \leq 0$ for some $x \in [1, 3]$
- $f(x) > 0$ for some $x \in [1, 3]$
- $f(x) \geq 0$ for some $x \in [1, 3]$
- $\int_{1}^{1.5} f(x)\,dx = -\int_{1.5}^{3} f(x)\,dx$

A. 0

B. 1

C. 2

D. 3

E. 4

Q13. If the graph of $y = f(x)$ translated 3 right and then reflected in the y-axis is identical to the graph of $y = f(x)$ reflected in the y-axis and then translated 3 right, which of the following **must** be true for all x ?

A. $f(x) + f(x + 6) = 2f(x + 3)$

B. $f(x) - f(x + 6) = 2f(x + 3)$

C. $f(x) + f(x + 12) = 2f(x + 6)$

D. $f(x) - f(x + 12) = 2f(x + 6)$

E. $f(x) + f(x + 3) = 2f(x + 6)$

Q14. The product of the roots of

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

is

A. -4

B. 4

C. -1

D. 1

E. 3

Q15. Which of the following functions is a counterexample to the statement

If $\int_0^1 f(x)\,dx = 0$

then $|f(x)| < 2$ for all $x \in [0, 1]$

A. $f(x) = 0$

B. $f(x) = 4x - 2$

C. $f(x) = sin(2\pi x)$

D. $f(x) = 1$

E. $f(x) = x^2 - x$

Q16. If α is a root of

$$x^3 + x^2 + x + 1 = 0$$

then

$$\sum_{n=0}^{1000} \alpha^n =$$

A. 0

B. 1

C. -1

D. $\alpha + 1$

E. $\alpha - 1$

Q17. For which of the following functions is

$$\frac{f(a)+f(b)}{2} \leq f\left(\frac{a+b}{2}\right)$$

true for all real numbers a, b where $a < b$?

A. $f(x) = 1 - x^2$

B. $f(x) = sin(x)$

C. $f(x) = e^x$

D. $f(x) = e^{-x}$

E. $f(x) = x^2 - 1$

Q18. Given that exactly one of the following is correct, which must it be?

A. $y < 2$ if $x > 6$

B. $x > 6$ if and only if $y < 2$

C. $y < 2$ only if $x > 6$

D. if $y \geq 2$ then $x \leq 6$

E. if $x \leq 6$ then $y \geq 2$

F. if $x \geq 6$ then $y \geq 2$

Q19.

$$\int_{-2}^{2} |x - 1||x + 1| \, dx =$$

A. 4

B. 3

C. 2

D. 1

E. 0

Q20. The length of the curve described by

$$2\,log_{10}(x + y) = log_{10}(1 + 2xy)$$

is

A. 0

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

C. π

D. $\frac{3\pi}{2}$

E. 2π