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TMUA MOCK PAPER ONE

75 Minutes

There are 20 questions on this TMUA Mock Paper One, created by the boffins at Gresty Academy to mirror the style and difficulty level of past TMUA 'Paper One' exams and provide more practice for our TMUA students. In our very subjective opinion, this mock paper is slightly harder than previous TMUA Paper One 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.

tmua.me editorial edition: corrections applied; original question numbering retained.
20 active questions.
Credit remains with the original author. Editorial history: model-answers/ALTERED-QUESTIONS.md in the repository.

Q1. If $y = min\{2x,\ 6x - x^2, 9 - x\}$

then $max\ (y) =$

A. 0

B. 1

C. 4

D. 6

E. 9

Q2. Evaluate

$$2^{20} + 4^{8} + 8^{4} + 16^{2} + 32^{0.8} + 64^{0}$$

A. $\frac{8^{6}-1}{7}$

B. $\frac{7^{6}-1}{8}$

C. $\frac{16^{6}-1}{15}$

D. $\frac{15^{6}-1}{16}$

Q3. The area of an equilateral triangle inscribed in a circle which is inscribed in a square of area $100m^2$ is

A. $\frac{75\sqrt{3}}{4}\ m^2$

B. $10\pi\ m^2$

C. $50\ m^2$

D. $\frac{25\pi}{4}\ m^2$

E. $10\pi\sqrt{(3)}\ m^2$

Q4. The sum of all the coefficients in the expansion of

$$(5x^2 - 3x - 1)^{2025}$$

is

A. 0

B. 1

C. $2^{2025} - 1$

D. 2^{2025}

E. $2^{2025} + 1$

Q5. The equation of a circle centred at the origin with tangent $y = mx + c$ is

A. $x^2 + y^2 = c^2 + m^2$

B. $x^2 + y^2 = c^2 - m^2$

C. $x^2 + y^2 = \frac{c^2}{m^2 - 1}$

D. $x^2 + y^2 = \frac{c^2}{m^2 + 1}$

Q6. These three equations (with real coefficients)

$$x - 1 + \sqrt{2} = 0$$
$$x^2 + px - 1 = 0$$
$$x^3 - 5x^2 + 5x + q = 0$$

share a root. So $p + q =$

A. 0

B. 1

C. 2

D. 3

E. 4

Q7. For what positive values of a does

$$ln(x) = ax^3$$

have no real solution for x ?

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

A. $a > \frac{1}{\sqrt[3]{e}}$

B. $a > \frac{1}{e}$

C. $a > \frac{1}{3e}$

D. $a > \frac{1}{3}$

E. $a > \sqrt[3]{e}$

Q8. Given two positive integers a and b, if the log to base 10 of their sum minus the log to base 10 of their difference equals 2, then the smallest possible value of the larger of a and b is

A. 0

B. 1

C. 99

D. 100

E. 101

Q9. If

$$f(x) = sin^2(Ax)$$

satisfies the functional equation

$$f(x) = f(x + 2)$$

then the minimum positive value of A is

A. 0

B. 1

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

D. 2

E. π

Q10. The sum of the gradients of the normals to the curve

$$y = \frac{2}{x^2}$$

at the points where $y = 1$ is

A. -2

B. -1

C. 0

D. 1

E. 2

Q11. The number of solutions to the equation

$$e^{2x} + x - 3 = 0$$

in the interval $[1, 100]$ is

A. 0

B. 1

C. 2

D. 3

E. 4

Q12. The second smallest value of $|x|$ for which

$$cos(3x + \frac{8\pi}{3}) = -\frac{\sqrt{3}}{2}$$

is

A. $\frac{\pi}{18}$

B. $\frac{\pi}{9}$

C. $\frac{\pi}{6}$

D. $\frac{2\pi}{9}$

E. $\frac{5\pi}{18}$

Q13. If

$$f(x) = 1 - \frac{1}{x}$$

then

$$f^{(999)}(x) =$$

[Note: $f^{(n)}(x)$ means the composite of f with itself n times]

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

B. 1

C. $1 + \frac{1}{x}$

D. x

E. $\frac{-1}{x-1}$

Q14. If

$$a_n = a_{n-1} + 6n \qquad \text{and} \qquad a_0 = 2$$

then

$$a_{100} =$$

A. $5,052$

B. $6,002$

C. $10,002$

D. $30,302$

E. $32,002$

Question 15

If $x > 0$ and

$$2\sqrt{2}x^2 = 1 + \sqrt{2}$$

then $x =$

A $\cos\left(\frac{\pi}{12}\right)$

B $\cos\left(\frac{\pi}{10}\right)$

C $\cos\left(\frac{\pi}{8}\right)$

D $\cos\left(\frac{\pi}{6}\right)$

E $\cos\left(\frac{\pi}{5}\right)$

This page contains an editorial correction to the supplied paper. The source paper is credited to its original author. Question IDs on this page: p022-q015.

Q16.

$$\sum_{k=2}^{100} log_{(\frac{1}{k})} k =$$

A. -100

B. -99

C. 0

D. 99

E. 100

Q17. Which sequence of transformations turns

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

into

$$y = \frac{(x-1)^2+2}{(x-4)^2-6}$$

A. Cannot be done

B. First shift 2 up then reflect in y-axis

C. First reflect in x-axis then shift 2 left

D. First reflect in x-axis then shift 2 down

E. First shift 2 left then reflect in y-axis

Q18. Which of the following has the most real solutions?

A. $\left|\frac{-2x+8}{x-3}\right| = -x$

B. $\left|\frac{-2x+8}{x-3}\right| = x$

C. $\left|\frac{-2x+8}{x-3}\right| = -3$

D. $\left|\frac{-2x+8}{x-3}\right| = 3$

Q19. The area of the region described by

$$4 \leq y \leq 10$$

and

$$x - 2 \leq y \leq x + 2$$

is

A. 20

B. 24

C. 28

D. 32

E. 36

Q20. Given that:

- θ is an angle of a triangle
- $cos(\theta) = -\frac{1}{2} + \frac{b}{a}$
- $a < b$
- $ab < 0$

then the range of possible values of θ is

A. $\frac{\pi}{3} \leq \theta < \pi$

B. $\frac{\pi}{3} < \theta \leq \pi$

C. $\frac{\pi}{3} < \theta < \pi$

D. $\frac{2\pi}{3} \leq \theta < \pi$

E. $\frac{2\pi}{3} < \theta < \pi$