

TMUA Challenge Paper 1 Tmua-p1-challenge-1

20 questions. Recreated from the publicly available paper.

Question 1

The positive real numbers x and y satisfy $\log_2 x + \log_4 y = 4$ and $\log_2 y + \log_4 x = 5$. Find the value of $\log_2(xy)$.

- A.4
- B.5
- C.6
- D.9
- E.12

Question 2

A circle passes through the three points $(0,0)$, $(6,0)$ and $(0,8)$. Find the length of the tangent drawn from the point $(10,10)$ to this circle.

A.5

B. $2\sqrt{15}$

C. $\sqrt{85}$

D. $2\sqrt{10}$

E. $\sqrt{50}$

Question 3

Find the coefficient of x^5 in the expansion of $(1+x)(1-2x)^7$.

A. -112

B. -672

C. 560

D. -560

E. 112

Question 4

A geometric series has all terms positive. The sum of its first two terms is 10 and its sum to infinity is 18. Find the least value of n for which the sum of the first n terms exceeds 17.

- A.6
- B.7
- C.8
- D.9
- E.10

Question 5

How many solutions does the equation $\tan x = 2 \sin x$ have in the interval $0^\circ < x < 360^\circ$?

A.2

B.3

C.4

D.5

E.6

Question 6

Find the minimum value of $\frac{x^2 + x + 4}{x}$ for $x > 0$.

A.4

B.5

C. $2\sqrt{5}$

D.6

E.3

Question 7

Find the area of the finite region enclosed between the curves $y = 4 - x^2$ and $y = x^2 - 4$.

A. $\frac{32}{3}$

B. $\frac{64}{3}$

C. 32

D. 16

E. $\frac{128}{3}$

Question 8

The cubic $x^3 + ax^2 + bx + 6$ has $x = 1$ and $x = 2$ among its roots. Find its third root.

A. -3

B. 3

C. -6

D. 6

E. -1

Question 9

Find the complete set of values of x satisfying $\frac{x-1}{x-2} \geq 2$.

A. $x \leq 3$

B. $2 < x \leq 3$

C. $x < 2$ or $x \geq 3$

D. $x \geq 3$

E. $2 \leq x \leq 3$

Question 10

How many four-digit whole numbers have digits that are strictly increasing from left to right (for example, 1358)?

A.126

B.210

C.3024

D.84

E.252

Question 11

How many integers n with $1 \leq n \leq 100$ are such that $n^2 + n + 1$ is divisible by 3?

A.33

B.34

C.66

D.67

E.50

Question 12

As θ varies over all real values, the expression $\frac{10}{2 + \cos \theta}$ takes a maximum value and a minimum value. Find the sum of these two values.

A.10

B. $\frac{40}{3}$

C. $\frac{50}{3}$

D. $\frac{20}{3}$

E.13

Question 13

Find the largest integer x for which $2^x > 3^{x-1}$.

A.1

B.2

C.3

D.4

E.there is no largest such integer

Question 14

The points $A(1, 1)$ and $B(5, 3)$ lie above the x -axis. A path runs from A to a point P on the x -axis and then to B . Find the least possible total length $AP + PB$.

A. $4\sqrt{2}$

B. $2\sqrt{5}$

C. 6

D. $\sqrt{20}$

E. $4\sqrt{3}$

Question 15

Evaluate $\sum_{r=1}^{20} (2r - 1)^2$.

A.10660

B.11480

C.5350

D.13530

E.9880

Question 16

The function f is defined for all real $x \neq 3$ by $f(x) = \frac{2x+1}{x-3}$. Which value can $f(x)$ never take?

A.3

B.2

C. $-\frac{1}{3}$

D.0

E. $\frac{1}{2}$

Question 17

Find the term independent of x in the expansion of $\left(2x^2 - \frac{1}{x}\right)^6$.

A.60

B.240

C.–60

D.15

E.–240

Question 18

The curve $y = x^3 + ax^2 + bx$ has a point of inflection at $(1, 0)$. Find the gradient of the curve at that point.

A. -1

B. 0

C. 1

D. -3

E. 2

Question 19

How many real solutions does the equation $|x^2 - 4| = x + 2$ have?

A.1

B.2

C.3

D.4

E.0

Question 20

The function f is defined for $x \geq 3$ by $f(x) = x^2 - 6x + 11$. Find $f^{-1}(6)$.

A.1

B.5

C.3

D.6

E.2

Answer key

1. Answer: C
2. Answer: B
3. Answer: A
4. Answer: C
5. Answer: B
6. Answer: B
7. Answer: B
8. Answer: A
9. Answer: B
10. Answer: A
11. Answer: B
12. Answer: B
13. Answer: B
14. Answer: A
15. Answer: A
16. Answer: B
17. Answer: A
18. Answer: A
19. Answer: C
20. Answer: B

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