

TMUA

Paper 1

Free Mock Paper

Mock paper: sit it in one go, under timed conditions.

Questions	20
Time allowed	75 minutes
Calculator	Not allowed
Marking	1 mark per question, no penalty

Instructions

- Answer **all 20 questions**. Each has exactly one correct option.
- You have **75 minutes**. That is about 225 seconds a question, so if you are stuck, move on and return if time allows.
- Each correct answer scores 1 mark. There is no penalty for a wrong or blank answer, so always give an answer.
- You **must not** use a calculator. Use the blank space for rough working.
- Write your answers on the answer grid at the end, or on paper. Mark the paper afterwards with the separate answer key and worked solutions.

Sit this paper in one go, with a timer, in a quiet place. Do not look at the solutions until you have finished. After marking, read the worked solution for every question you missed *and* every question you guessed.

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1 What is the value of $\frac{10}{3 - \sqrt{5}} - \frac{10}{3 + \sqrt{5}}$?

A 5

B $\frac{5\sqrt{5}}{2}$

C 10

D $5\sqrt{5}$

E $10\sqrt{5}$

F 25

2 The fourth term of an arithmetic sequence is 17 and the ninth term is 42. What is the sum of the first 20 terms?

A 970

B 990

C 1000

D 1010

E 1090

F 1980

- 3 The mean score of 12 students in a test is 63. The mean score of the 5 girls among them is 70. What is the mean score of the 7 boys?
- A 66
- B 65
- C 62
- D 60
- E 58
- F 56
-
- 4 The polynomial $p(x) = x^3 + ax^2 + bx - 6$ has $(x - 1)$ as a factor, and leaves remainder 12 when divided by $(x + 1)$. What is the value of a ?
- A -12
- B -7
- C 5
- D 7
- E 12
- F 19

- 5 The graph of $y = f(x)$ has a maximum point at $(4, -1)$ and no other turning point. The graph of $y = 3 - 2f(x + 1)$ has a turning point. Which of the following describes it?
- A a minimum point at $(3, 5)$
 - B a minimum point at $(5, 5)$
 - C a maximum point at $(3, 5)$
 - D a minimum point at $(3, 1)$
 - E a minimum point at $(3, 2)$
 - F a maximum point at $(5, 2)$
-
- 6 A triangle has sides of length 5, 6 and 7. What is its area?
- A $3\sqrt{6}$
 - B $6\sqrt{3}$
 - C $6\sqrt{6}$
 - D 15
 - E $12\sqrt{3}$
 - F $9\sqrt{6}$

- 7 A circle has centre $(2, -3)$ and passes through the point $P(5, 1)$. The tangent to the circle at P crosses the x -axis at the point Q . What is the x -coordinate of Q ?
- A 13
- B 11
- C $\frac{25}{3}$
- D 7
- E $\frac{19}{3}$
- F $\frac{23}{4}$
-
- 8 The trapezium rule with 4 strips of equal width is used to estimate $\int_0^4 \sqrt{x} \, dx$. What is the estimate?
- A $1 + \sqrt{2} + \sqrt{3}$
- B $2 + \sqrt{2} + \sqrt{3}$
- C $\frac{16}{3}$
- D $3 + \sqrt{2} + \sqrt{3}$
- E 8
- F $4 + 2\sqrt{2} + 2\sqrt{3}$

- 9 A bag contains 5 red, 4 blue and 3 green counters. Two counters are taken from the bag at random, one after the other, without replacement. What is the probability that they are the same colour?
- A $\frac{5}{22}$
- B $\frac{19}{72}$
- C $\frac{19}{66}$
- D $\frac{7}{22}$
- E $\frac{1}{3}$
- F $\frac{25}{72}$
-
- 10 The function $f(x) = x^3 - 6x^2 + kx + 5$, where k is a constant, is decreasing for exactly those values of x that lie in an interval of length 2. What is the local minimum value of f ?
- A 21
- B 13
- C 9
- D 5
- E 3
- F 1

11 Given that $\log_5 2 = p$ and $\log_5 3 = q$, express $\log_{15} 12$ in terms of p and q .

- A $\frac{2p+q}{q}$
- B $\frac{2p+q}{p+q}$
- C $2p+q$
- D $\frac{p+2q}{1+q}$
- E $\frac{2pq}{1+q}$
- F $\frac{2p+q}{1+q}$

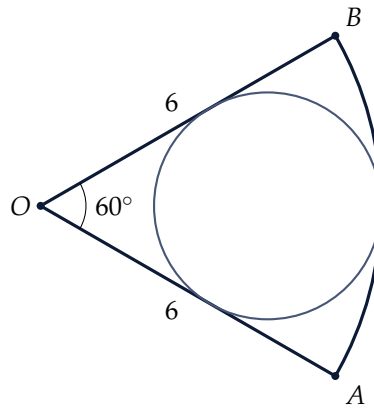
12 How many solutions does the equation $\sin 2x = \cos x$ have in the interval $0 \leq x < 2\pi$?

- A 8
- B 6
- C 5
- D 4
- E 3
- F 2

- 13** What is the total area of the finite regions enclosed by the curve $y = x^3 - 4x$ and the x -axis?
- A** 0
- B** 4
- C** 8
- D** 12
- E** 16
- F** 32
-
- 14** In the expansion of $(1 + ax)^n$ in ascending powers of x , where n is a positive integer and a is a constant, the coefficient of x is 12 and the coefficient of x^2 is 60. What is the coefficient of x^3 ?
- A** 320
- B** 240
- C** 160
- D** 120
- E** 80
- F** 20

- 15** An open rectangular box (with no lid) has a square base. The total area of its base and four sides is 48 cm^2 . What is the greatest possible volume of the box, in cm^3 ?
- A** 16
- B** 24
- C** 32
- D** 36
- E** 48
- F** 64

- 16** The diagram shows a sector OAB of a circle with centre O and radius 6, in which $\angle AOB = 60^\circ$. A smaller circle lies inside the sector and touches both straight edges OA and OB and the arc AB . What is the area of the region that is inside the sector but outside the smaller circle?



- A** π
- B** 2π
- C** 3π
- D** 4π
- E** 5π
- F** 6π

- 17** The positive real numbers a and b satisfy $a^2 + b^2 = 14ab$. What is the value of $\log_2(a + b) - \frac{1}{2}\log_2 a - \frac{1}{2}\log_2 b$?
- A** 14
- B** 7
- C** 4
- D** 3
- E** 2
- F** 1

- 18** What is the value of $-1^2 + 2^2 - 3^2 + 4^2 - \dots - 39^2 + 40^2$, that is, of $\sum_{k=1}^{40} (-1)^k k^2$?
- A** 1640
- B** 820
- C** 800
- D** 780
- E** 20
- F** -820

- 19** The point P lies on the circle $x^2 + y^2 - 4x - 6y - 12 = 0$. The points O and A are $(0,0)$ and $(6,8)$. What is the greatest possible area of triangle OAP ?
- A** 50
- B** 30
- C** 27
- D** 26
- E** 25
- F** 24
-
- 20** Ten chairs are placed at equal intervals round a circular table. In how many ways can three of the chairs be chosen so that no two of the chosen chairs are next to each other?
- A** 70
- B** 60
- C** 56
- D** 50
- E** 40
- F** 35

Answer grid

1 ____ 2 ____ 3 ____ 4 ____ 5 ____ 6 ____ 7 ____ 8 ____ 9 ____
10 ____ 11 ____ 12 ____ 13 ____ 14 ____ 15 ____ 16 ____ 17 ____ 18 ____
19 ____ 20 ____