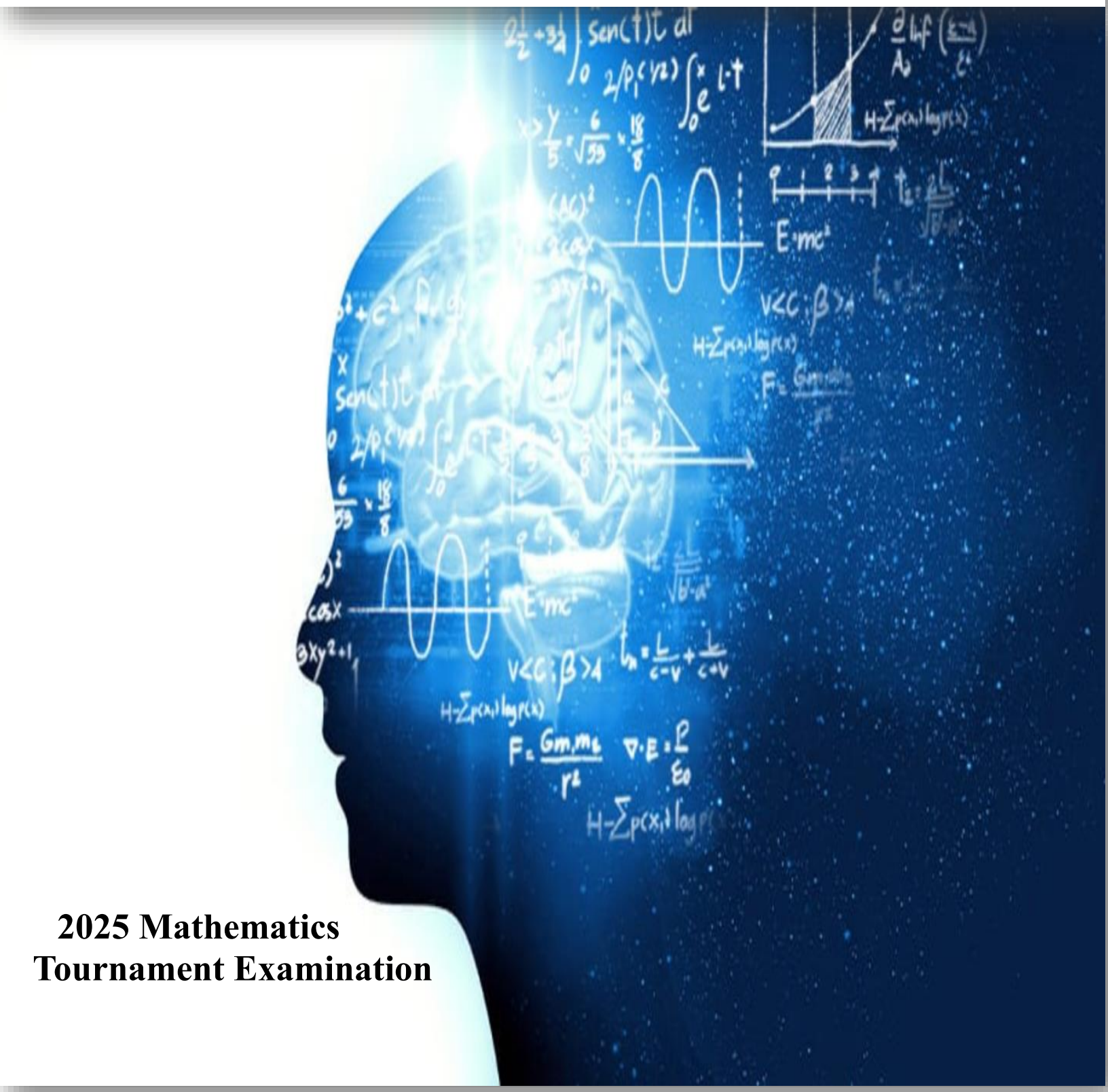
Albany State University

Department of Mathematics, Computer Science and Physics



2025 Mathematics Tournament Examination

February 7, 2025
Time: 2 Hours

Name: _____ **School:** _____

This test consists of 40 multiple choice questions. Attempt all questions and submit your answers on the scantron sheet provided. Good Luck!

Question #1:

The total cost, in dollars, to rent a surfboard consists of a $25 service fee and a $10 per hour rental fee. A person rents a surfboard for *t* hours and intends to spend a maximum of $75 to rent the surfboard.

Which inequality represents this situation?

A) $25 + 10t \leq 75$

B) $10t \leq 75$

C) $10 + 25t \leq 75$

D) $25t \leq 75$

E) None of the above

Question #2:

If $x \neq 3, y \neq -5, and\ xy = 15, which\ of\ the\ following\ is\ equivalent\ to\ \frac{1}{\frac{1}{x-3}+\frac{1}{y+5}}$?

A) $\frac{5x-3y}{x+y+2}$

B) $\frac{x+y+2}{(x-3)(y+5)}$

C) $\frac{(x+3)(y-5)}{x+y+2}$

D) $\frac{5-3}{2}$

E) None of the above

Question #3:

x	y
18	130
23	160
26	178

For line h, the table above shows three values of x and their corresponding values of y. Line k is the result of translating line h down 5 units in the xy-plane. What is the x-intercept of line k?

A) $\left(-\frac{9}{2}, 0\right)$

B) $\left(-\frac{26}{3}, 0\right)$

C) $\left(-\frac{11}{3}, 0\right)$

D) $\left(-\frac{17}{6}, 0\right)$

E) None of the above

Question #4:

If 3x – y = 12, what is the value of $\frac{8^x}{2^y}$?

A) 4^4

B) 2^{12}

C) 8^2

D) 2^8

E) The value cannot be determined from the information given.

Question #5:

What is the area of a town with an area of 4.36 square miles in square yards? (1 mile = 1760 yards)

A) 404

B) 7,674

C) 710,459

D) 13,505,536

E) None of the above

Question #6:

There exists a unique real value of x such that $(x + \sqrt{x})^2 = 16$. Compute x.

A) $\frac{6 - \sqrt{7}}{2}$

B) $\frac{7 + \sqrt{7}}{2}$

C) $\frac{9 - \sqrt{17}}{2}$

D) $\frac{7 - \sqrt{13}}{2}$

E) $\frac{9 + \sqrt{17}}{2}$

Question #7:

In a sample of 200 students, the probability of passing a math exam is 0.75. If students are chosen at random, what is the probability that at least 150 pass the exam? Use the normal approximation to the binomial distribution.

A) 0.53

B) 0.08

C) 0.20

D) 0.12

E) None of the above

Question #8:

How many numbers of three digits can be formed using digits 1, 3, 5, 7, and 9, if each digit is used at most once?

A) 983

B) 5430

C) 345

D) 120

E) None of the above

Question #9:

Simplify the expression:

$(2x + 3)(x - 5) - (x - 1)(x + 2)$.

A) $x^2 - 9x + 13$

B) $x^2 - 7x + 11$

C) $x^2 - 8x + 14$

D) $x^2 - 6x + 12$

E) None of the above

Question #10:

If a circle's radius triples, how many times greater is its area?

A) 3

B) 6

C) 9

D) 12

E) None of the above

Question #11:

Circle A has a radius of $3n$ and Circle B has a radius of $129n$, where n is a positive constant. The area of Circle B is how many times the area of Circle A?

A) 43

B) 86

C) 1,849

D) 129

E) None of the above

Question #12:

Which expression is equivalent to $6x^8y^2 + 12x^2y^2$?

A) $6x^2y^2(x^6 + 2)$

B) $6x^2y^2(2x^6)$

C) $6x^2y^2(x^4)$

D) $6x^2y^2(x^4 + 2)$

E) None of the above

Question #13:

In a certain city, it was reported that 50.8% of all burglaries in 2022 were committed using a stolen vehicle. If four burglary cases from 2022 are selected at random, find the probability that a stolen vehicle was used in at least one of the four cases.

A) 88.09%

B) 20.32%

C) 86.89%

D) 4.92%

E) None of the above

Question #14:

Suppose p and q are two distinct real numbers and the $f(x) = x^2 + px + q$ satisfies $f(p) = f(q)$. What is the value of $f(2)$?

A) 4

B) 5

C) 3

D) 2

E) None of the above

Question #15:

A large manufacturing company employs 100 engineers who are either there to maintain machines or to maintain security. If 45 are trained to maintain the preform machine, 30 are trained for the assembling machine, and 20 are trained for the packaging machine:

- 6 are trained on both the preform and assembling machines,
- 1 is trained on both the preform and packaging machines,
- 5 are trained on both the assembling and packaging machines,
- 1 is trained on all three machines.

All engineers not trained to maintain the machines are tasked with maintaining security. How many engineers are employed to maintain security?

A) 14

B) 18

C) 16

D) 20

E) 22

Question #16:

What is the value of $\log_2(27) \cdot \log_3(25) \cdot \log_5(32)$

A) 36

B) 29

C) 30

D) 32

E) None of the above

Question #17:

A test for a rare disease has a sensitivity (true positive rate) of 99% and a specificity (true negative rate) of 95%. If the disease prevalence in the population is 1 in 1000, what is the approximate probability that a person testing positive actually has the disease?

A) 9%

B) 50%

C) 19%

D) 2%

E) None of the above

Question #18:

How many 4-digit integers are there which are divisible by 4?

A) 4500

B) 2250

C) 2500

D) 9000

E) None of the above

Question #19:

A drawer contains 12 red and 12 blue socks, all unmatched. A person takes socks out at random in the dark. How many socks must he take out to be sure that he has at least two blue socks?

A) 18

B) 14

C) 35

D) 28

E) None of the others

Question #20:

Evaluate the sum:

$$1+\frac{1}{3}+\frac{1}{6}+\frac{1}{10}+\frac{1}{15}+\cdots.+\frac{1}{a}+\cdots \quad with\ a=\frac{n(n+1)}{2} \quad n\in\mathbb{N}$$

A) ∞

B) 3

C) 2

D) 10

E) None of the above

Question #21:

Solve the equation:

$$\mathbf{9^x + 15^x = 25^x}$$

A) $x = \frac{Ln(-1+\sqrt{5})-ln2}{Ln3-Ln5}$

B) $x = \frac{Ln(1+\sqrt{5})-Ln25}{Ln9-Ln15}$

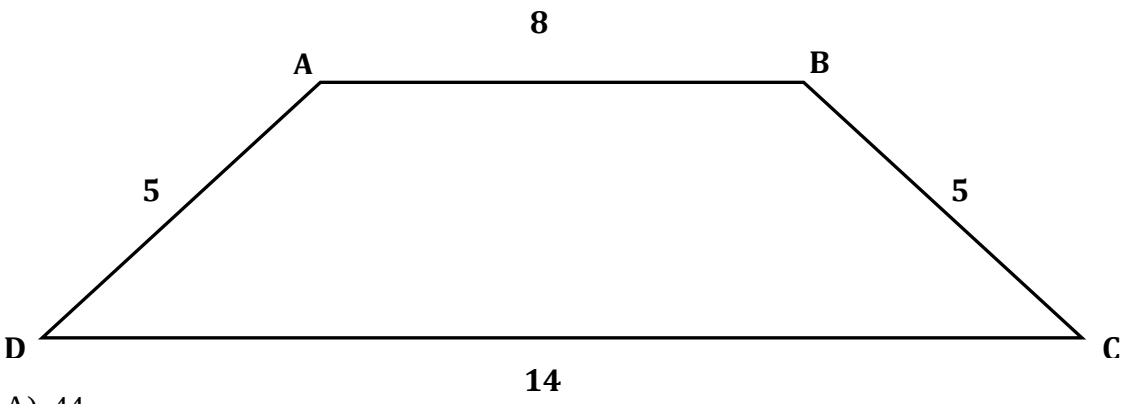
C) $x = \frac{Ln(3+\sqrt{24}-ln9}{Ln15-Ln25}$

D) $x = \frac{Ln(1+\sqrt{5})-ln2}{Ln15-Ln25}$

E) None of the above

Question #22:

What is the area of the trapezoid *ABCD* given below, in which sides *AB* and *CD* are parallel?



A) 44

B) 30

C) 40

D) 48

E) 60

Question #23:

If $f(x+2) = 7x - 12$, what is the value of $f(5)$?

A) – 12

B) 23

C) 47

D) 9

E) – 5

Question #24:

If $X + Y = 8$, and $log_2(XY) = 2$, then what is Y?

A) $4 \pm 3\sqrt{2}$

B) $6 \pm 6\sqrt{2}$

C) $4 \pm 2\sqrt{3}$

D) $5 \pm 2\sqrt{3}$

E) $8 \pm 3\sqrt{2}$

Question #25:

Suppose $z_1, z_2, and\ z_3$ are the three roots of $z^3 - 18z - 8 = 0$.

Simplify $A = \frac{(z_1 - z_2)^2 (z_2 - z_3)^2 (z_3 - z_1)^2}{200}$

A) 160

B) 216

C) 108

D) 312

E) 427

Question #26:

Solve the following problem for x

$$\frac{x}{x-3} + 4 = \frac{2x-3}{x-3}$$

A) 3

B) -3

C) No Solution

D) 0

E) -1

Question #27:

Given $\sqrt{5x^2 + 2x + 34 + 7y^2} = 2x + 3$.

Find $5x - 6y$.

A) 10-2y

B) $\sqrt{5x - y}$

C) 25

D) $\sqrt{x + 7y}$

E) None of the above

Question #28:

Find the determinant of the matrix [[2, 3], [1, 4]].

A) 5

B) 8

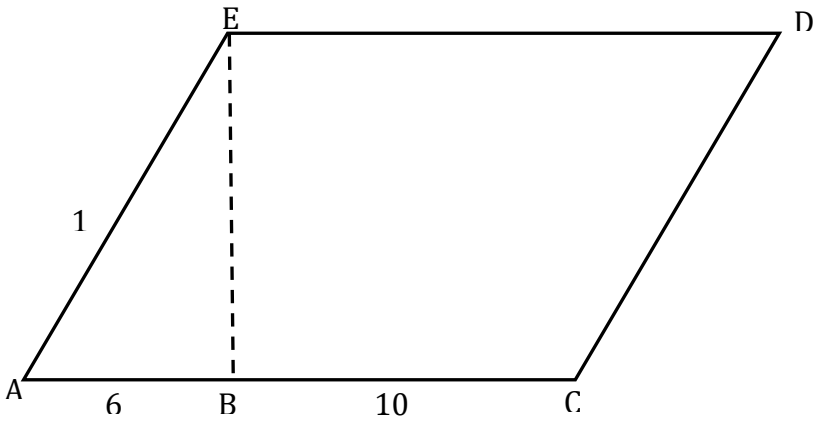
C) 10

D) 20

E) None of the above

Question #29:

AEDC is a parallelogram, with the length of $\overline{AB}$ = 6 units, the length of $\overline{BC}$ = 10 units, and the length of $\overline{AE}$ = 10 units. Point B is on $\overline{AC}$ and $\overline{BE}$ is perpendicular to $\overline{AC}$. What is the area of the parallelogram AEDC in square units?



A) 120

B) 130

C) 128

D) 132

E) 160

Question #30:

If $x^2 + y^2 = 25$ and $xy = 6$, what is the value of $(x + y)^2$?

A) 37

B) 49

C) 55

D) 61

E) 100

Question #31:

Find the distance between points (3, -2) and (-3, 4).

A) 5

B) 7

C) 10

D) 14

E) None of the above

Question #32:

Find the number of ways to arrange the letters in the word "MATHEMATICS".

A) 11!

B) $\frac{11!}{2!}$

C) $\frac{11!}{2! \, x \, 2!}$

D) 15!

E) None of the above

Question #33:

If log(x) + log (2x - 3) = 1, solve for x.

A) 3

B) 5

C) 7

D) 0

E) None of the above

Question #34:

How many even 4-digit whole numbers are there?

A) 4500
B) 1358
C) 7250
D) 3600
E) None of the above

Question #35:

A bag contains 4 red, 5 blue, and 6 green marbles. If two marbles are drawn at random without replacement, what is the probability that both marbles are blue?

A) 2/21
B) 1/21
C) 5/91
D) 1/7
E) None of the above

Question #36:

A player pays $3 to roll two six-sided dice. They win $12 if the sum is 7, $8 if the sum is less than 4, and $6 if the sum is greater than 10. Calculate the expected value of the game, and choose the correct answer from the options below.

A) $-0.45
B) $1.17
C) $0.17
D) $-0.20
E) None of the above

Question #37:

Solve the equation:

$\mathbf{3^x - 2^x = \sqrt{6^x}}$

A) $x = \frac{Ln(3+\sqrt{6})-ln2}{Ln6-Ln2}$

B) $x = \frac{2\ln(1+\sqrt{5})-Ln4}{Ln3-Ln2}$

C) $x = \frac{Ln(3+\sqrt{6})+ln2}{Ln6-Ln2}$

D) $x = \frac{Ln(3+\sqrt{6})-ln2}{Ln3-Ln2}$

E) None of the above

Question #38:

Given:

$\mathbf{\sqrt{3x^2+10x+24} - \sqrt{3x^2+10x-24} = 6}$

Find: $\sqrt{\mathbf{5x^2 + x + \frac{4}{9}}}$

A) 4, or $\frac{\sqrt{1084}}{3}$

B) $\frac{5\sqrt{3}}{2}, or \ \frac{5-3\sqrt{3}}{2}$

C) $\frac{1+\sqrt{13}}{8}$, or $\frac{1-\sqrt{13}}{8}$

D) 6, or $\frac{5-3\sqrt{3}}{2}$

E) None of the above

Question #39:

What is the integral of x^3 from 0 to 2?

A) 4

B) 8

C) 16

D) 32

E) None of the above

Question #40:

Solve the equation:

$3x + 7 = 22$

A) 33

B) 55

C) 77

D) 88

E) None of the above

Examination Completed!

2025 Mathematics
Tournament Examination
Answer Key

1.	**A**	21.	**A**
2.	**A**	22.	**A**
3.	**B**	23.	**D**
4.	**B**	24.	**C**
5.	**D**	25.	**C**
6.	**C**	26.	**C**
7.	**A**	27.	**C**
8.	**D**	28.	**A**
9.	**B**	29.	**C**
10.	**C**	30.	**A**
11.	**C**	31.	**C**
12.	**A**	32.	**C**
13.	**A**	33.	**A**
14.	**A**	34.	**A**
15.	**C**	35.	**A**
16.	**C**	36.	**C**
17.	**D**	37.	**B**
18.	**A**	38.	**A**
19.	**B**	39.	**A**
20.	**C**	40.	**E**