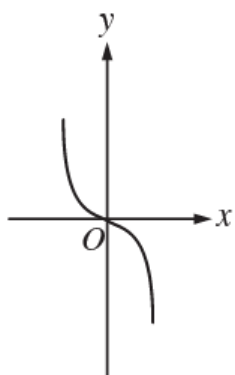


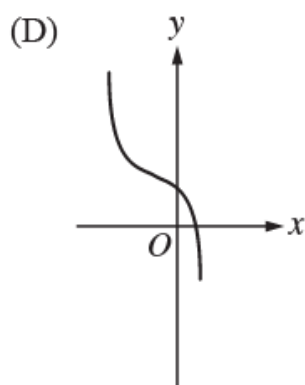
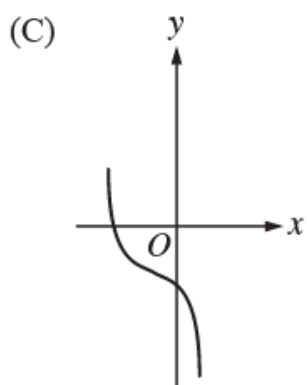
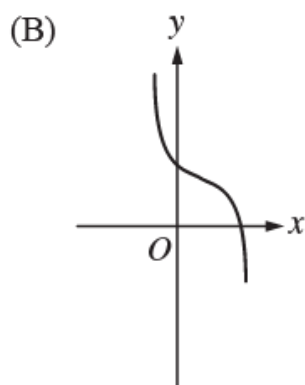
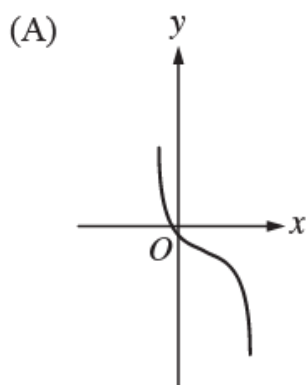
1. The area of a rectangular region with adjacent sides of lengths a and b , respectively, can be used to represent the product ab . What product is represented by the shaded rectangular region in the figure above?
- (A) 4×3
(B) 4×20
(C) 10×4
(D) 10×20

2. José is considering what sandwich to buy for lunch. He has a choice of 2 different types of bread, 3 different types of cheese, and 4 different types of meat. For any sandwich, he must choose one type of bread, and either one type of cheese or one type of meat, or one type of cheese and one type of meat. How many different sandwiches can he choose?

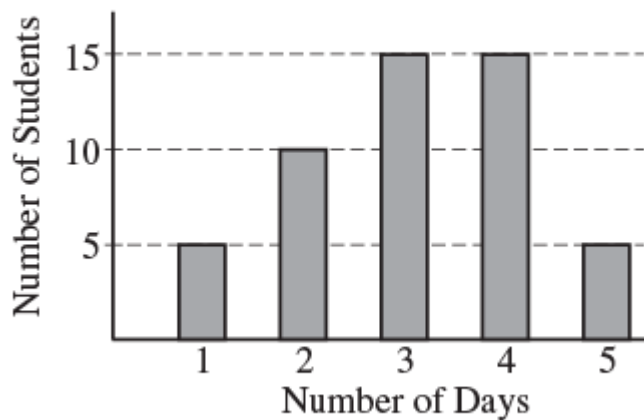
- (A) 14
- (B) 24
- (C) 38
- (D) 48



3. If the graph of the function $y = f(x)$ is shown above, which of the following could be the graph of $y = f(x + 1) - 2$?

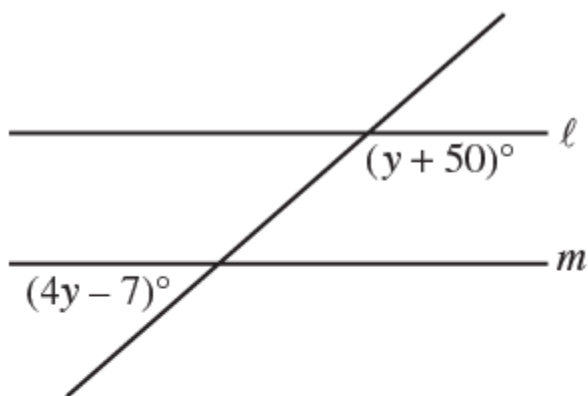


NUMBER OF DAYS TAKEN TO COMPLETE
A CERTAIN ASSIGNMENT

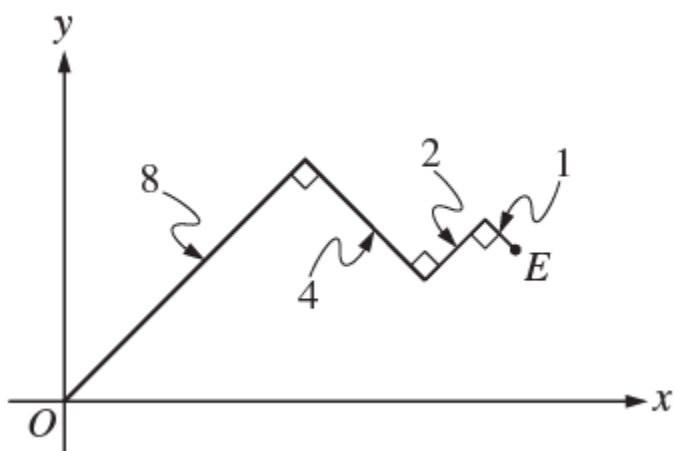


4. An assignment was given to 50 middle-school students to complete. The graph above shows a frequency distribution of the number of days it took the students to complete the assignment. What is the mean number of days it took for a student to complete the assignment?
- (A) 2.8
(B) 3.0
(C) 3.1
(D) 3.3

5. The graph of the axis of symmetry of the parabola $y = 2x^2 - 11x + 3$ is best described by which of the following equations?
- (A) $x = 2$
(B) $x = 2.25$
(C) $x = 2.5$
(D) $x = 2.75$



6. In the figure above, lines l and m are parallel. What is the value of y ?
- (A) 19
(B) $\frac{137}{5}$
(C) $\frac{223}{5}$
(D) $\frac{137}{3}$



7. In the figure above, what is the distance from point E to the origin?
- (A) 10
- (B) 15
- (C) $5\sqrt{5}$
- (D) $\frac{5\sqrt{10}}{2}$

8. If $\tan x = \frac{2}{3}$ and $\pi < x < \frac{3\pi}{2}$, then

$\cos x =$

(A) $\frac{3}{\sqrt{13}}$

(B) $\frac{2}{\sqrt{13}}$

(C) $-\frac{2}{\sqrt{13}}$

(D) $-\frac{3}{\sqrt{13}}$

9. If A is a 2×2 matrix and $A \begin{pmatrix} x \\ y \end{pmatrix} = 3 \begin{pmatrix} x \\ y \end{pmatrix}$

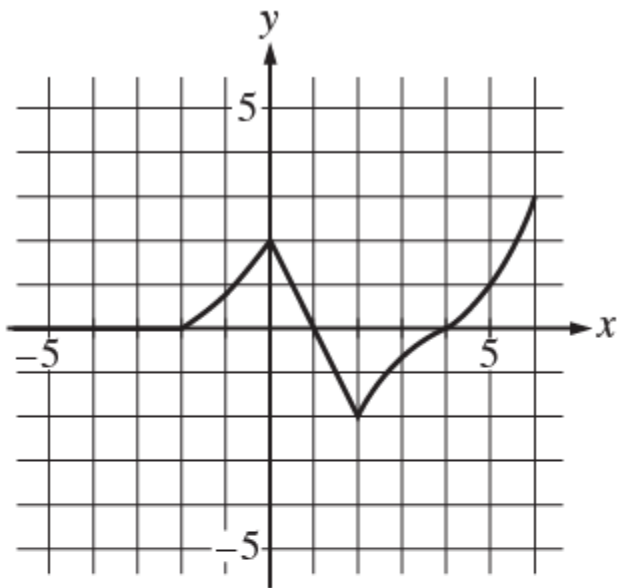
for all real x and y , then $A =$

(A) $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$

(B) $\begin{pmatrix} 3 & 0 \\ 0 & 0 \end{pmatrix}$

(C) $\begin{pmatrix} 3 & 3 \\ 3 & 3 \end{pmatrix}$

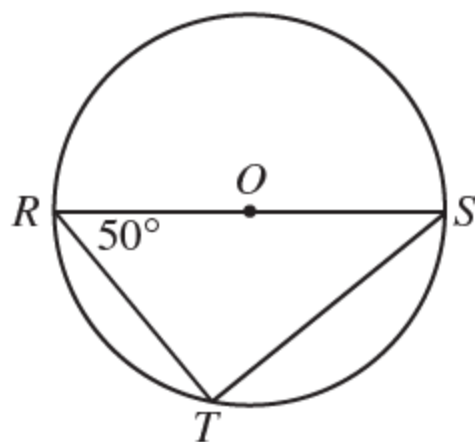
(D) $\begin{pmatrix} 0 & 3 \\ 3 & 0 \end{pmatrix}$



10. The graph of the integrable function $y = f(x)$ is shown above. Which of the following is the best approximation of

$$\int_{-2}^4 f(x) dx?$$

- (A) 7
 (B) 5
 (C) 2
 (D) 0
11. In a league that has 5 teams, each team plays each of the other teams twice in a season. What is the total number of games played during the season?
- (A) 10
 (B) 12
 (C) 20
 (D) 24



12. In the circle above with center O , what is the degree measure of arc RT ?

- (A) 40°
- (B) 50°
- (C) 80°
- (D) 90°

13. Beginning at time $t = 0$, the number of rabbits in a certain population at time t years is modeled by the function

$$f(t) = \frac{10,000}{10 + 50e^{-0.5t}}.$$
 According to

this model, which of the following best describes how the size of the population changes over time?

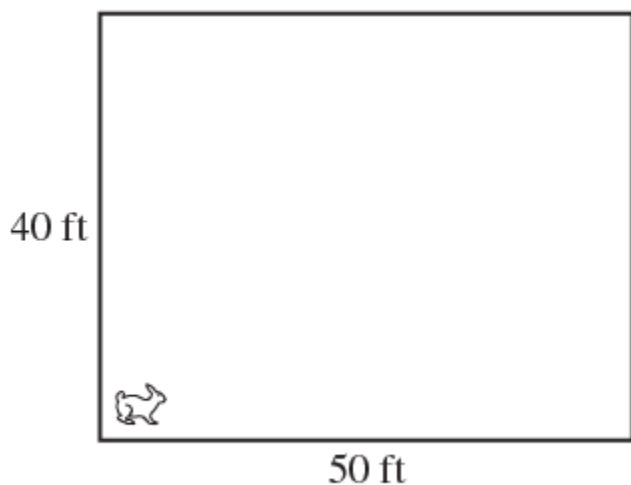
- (A) It increases without bound.
- (B) It increases for several years and then levels off.
- (C) It increases for several years and then decreases to zero.
- (D) It increases and decreases in cycles.

14. The Richter scale is a base 10 logarithmic scale used to measure the magnitude of earthquakes; i.e., an earthquake measuring 7 is ten times as strong as an earthquake measuring 6. An earthquake that measures 6.8 on the Richter scale has a magnitude that is approximately what percent of that of an earthquake measuring 6.6 ?

- (A) 103%
- (B) 120%
- (C) 158%
- (D) 200%

15. The surface area of a sphere is approximately 1,500 square inches. What is the approximate volume of the sphere, in cubic inches?

- (A) 500
- (B) 1,500
- (C) 3,500
- (D) 5,500



16. A rabbit is hopping around in a fenced-off flat rectangular field with dimensions as shown above. If the position of the rabbit is uniformly random throughout the field, what is the probability that the rabbit is 10 feet or more away from the fence at any given time?
- (A) 0.80
(B) 0.75
(C) 0.60
(D) 0.30

17. If a differentiable function is strictly increasing on the real numbers, which of the following statements about the function's derivative must be true?
- (A) It is always positive and strictly increasing.
 - (B) It is always positive but need not be strictly increasing.
 - (C) It need not always be positive but is always strictly increasing.
 - (D) It need not always be positive and need not always be strictly increasing.
18. Which of the following sets is NOT closed under division?
- (A) Integers, excluding 0
 - (B) Rational numbers, excluding 0
 - (C) Real numbers, excluding 0
 - (D) Complex numbers, excluding 0

19. Given $f(x) = 4x$, $g(x) = x^2 + 1$, and

$h(x) = \frac{1}{x}$, for what value or values

of x is $h(f(g(x))) = \frac{1}{4}$?

(A) 0

(B) $\frac{\sqrt{3}}{2}$

(C) $\pm \frac{\sqrt{3}}{2}$

(D) $\pm i \frac{\sqrt{15}}{15}$

20. If $\frac{3}{7}$ is expressed in decimal form, what digit is in the 19th decimal place?

(A) 1

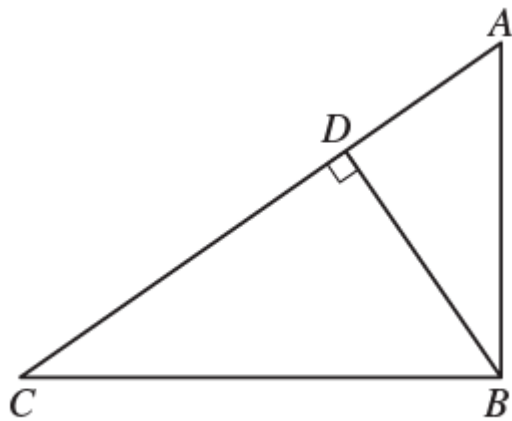
(B) 2

(C) 4

(D) 5

Years Since 1960	Price of a Gallon of Milk (dollars)
0	\$0.49
5	\$0.95
10	\$1.15
15	\$1.57
20	\$2.16
25	\$2.26
30	\$2.78
35	\$2.96
40	\$3.15

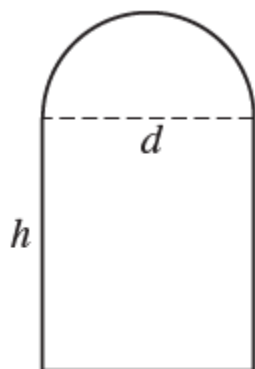
21. The prices p of a gallon of milk in a certain part of the country from 1960 to 2000 are shown in the table above. A least-squares regression line for the nine data points is $p = a + bt$, where $a = 0.57$, $b = 0.069$, and t is the number of years since 1960. For the year 2005, what is the value for the price of a gallon of milk as predicted by the regression line?
- (A) \$3.22
(B) \$3.34
(C) \$3.50
(D) \$3.68



22. In the figure above, ABC is a right triangle with right angle at B . \overline{BD} is perpendicular to \overline{AC} . If $CD = 9$ and $AD = 3$, then $BC + AB + BD =$
- (A) $6 + 9\sqrt{3}$
(B) $6\sqrt{3} + 9$
(C) $2\sqrt{2} + 7$
(D) $4 + 3\sqrt{2}$
23. In the course of solving an equation, which of the following procedures can result in an equation that yields a real root that does not satisfy the original equation?
- (A) Subtracting the same number from both sides of the equation
(B) Raising both sides of the equation to the third power
(C) Squaring both sides of the equation
(D) Dividing both sides of the equation by a nonzero number

24. If the real-valued function $f(x) = x^n$, where n is a positive integer, has neither a local maximum nor a local minimum, which of the following must be true?

- (A) n is even.
- (B) n is odd.
- (C) n is a multiple of 3.
- (D) n can be any positive integer.



25. A glass window is composed of a rectangle that is h feet long by d feet wide and a semicircle with diameter d , as shown in the figure above. If the area of the semicircular region is $\frac{1}{3}$ of the total area of the window, what is the ratio of h to d ?
- (A) π to 2
(B) π to 3
(C) π to 4
(D) It cannot be determined from the information given.

26. Which of the following is the solution set of the matrix equation

$$\begin{bmatrix} 1 & -1 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = 2 \begin{bmatrix} x \\ y \end{bmatrix} ?$$

(A) $\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix} \right\}$

(B) $\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \end{bmatrix} \right\}$

(C) $\left\{ \begin{bmatrix} -c \\ c \end{bmatrix}, \text{ where } c \text{ is any real number} \right\}$

- (D) There are no solutions to the matrix equation.

27. Karen opened a bank account for her son on his 1st birthday with a \$100 deposit. After that, \$50 was deposited into the account on each birthday. No withdrawals and no other deposits were made until his 11th birthday. The bank pays 8% interest per year, compounded annually. Which of the following recursive sequences models the amount of money in the account after n years, $1 \leq n \leq 10$?

(A) $A(0) = 100$

$$A(n) = 0.08A(n-1) + 50$$

(B) $A(0) = 100$

$$A(n) = 1.08A(n-1) + 50$$

(C) $A(0) = 100$

$$A(n) = 0.08[A(n-1) + 50]$$

(D) $A(0) = 0$

$$A(n) = 1.08[A(n-1) + 100] + 50$$

\times	a	b
a	b	a
b	a	a

28. The table above defines an operation \times on the set $S = \{a, b\}$. Which of the following statements about \times is true?

- (A) It is neither associative nor commutative.
- (B) It is associative but not commutative.
- (C) It is commutative but not associative.
- (D) It is both associative and commutative.

29. In the xy -plane, what is the radius of the circle described by the equation $x^2 + 2x + y^2 = 0$?

- (A) 1
- (B) 2
- (C) 3
- (D) 4

30. What is the period of the function

$$y = \frac{1}{3} \sin\left(\frac{1}{2}x + \frac{\pi}{3}\right)?$$

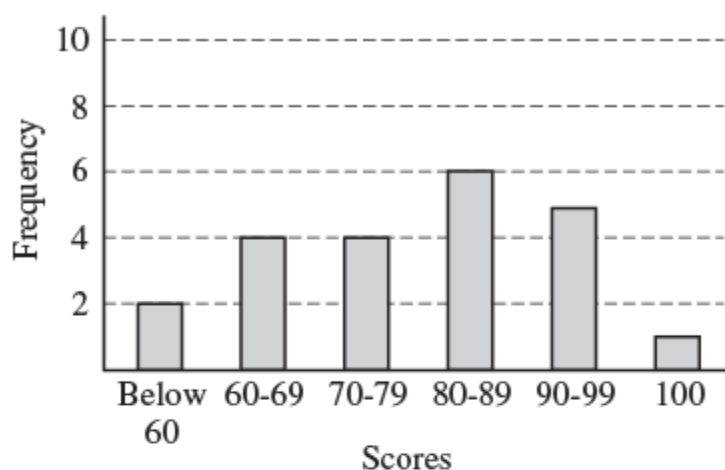
(A) $\frac{1}{3}$

(B) $\frac{\pi}{6}$

(C) π

(D) 4π

SCORES ON AN ALGEBRA I TEST



31. Which of the following statistics about the Algebra I test scores can be determined using only the information above?
- I. The range of the scores
 - II. The median score
 - III. The average (arithmetic mean) score
- (A) None
(B) I only
(C) II only
(D) III only

32. The function $f(x) = x^3 + 1$ is one-to-one; therefore, the inverse function $y = f^{-1}(x)$ exists. Which of the following is an equation for $y = f^{-1}(x)$?

(A) $y = \frac{1}{x^3 + 1}$

(B) $y = \sqrt[3]{x - 1}$

(C) $y = \sqrt[3]{x} - 1$

(D) $y = \frac{1}{\sqrt[3]{x - 1}}$

33. Consider the set S of 2×2 matrices, all of whose entries are nonzero real numbers. Which of the following properties is satisfied by S under multiplication?

- I. S is closed.
- II. S is commutative.
- III. S contains an identity.

- (A) None
- (B) I only
- (C) I and II only
- (D) I and III only

34. A sequence is defined recursively by

$$a_n = \begin{cases} 1 & \text{if } n = 1 \\ a_{n-1} + n & \text{if } n > 1 \end{cases}.$$

Which of the following is a closed-form representation of the sequence?

(A) $a_n = \frac{(n-1)n}{2}$

(B) $a_n = \frac{n+1}{2}$

(C) $a_n = \frac{n(n+1)}{2}$

(D) $a_n = n^2 - (n-1)(n+1)$

35. For which of the following values

of x is $f(x) = \frac{\sqrt{x^2 + 4}}{x^3 + x^2 - 5x + 3}$

undefined?

I. -3

II. -2

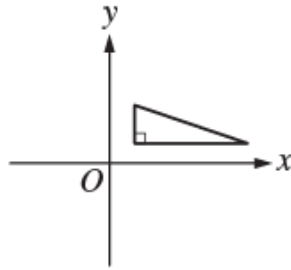
III. 1

(A) I only

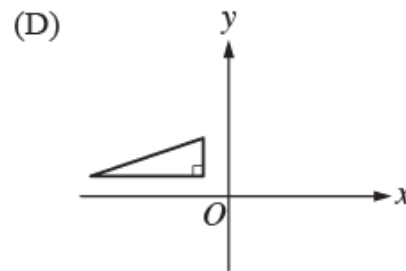
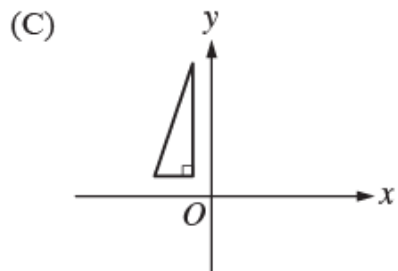
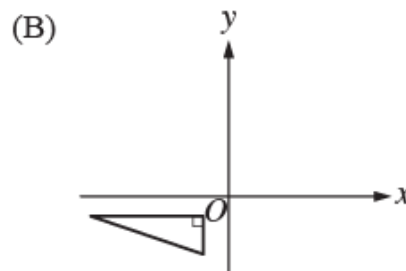
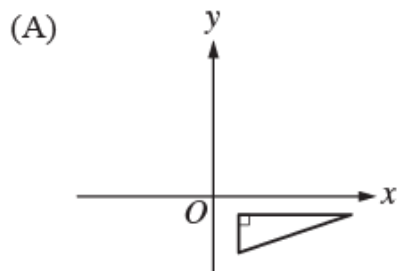
(B) II only

(C) I and III only

(D) I, II, and III



36. The triangle shown in the plane above is to be transformed in the plane by being reflected about the line $y = -x$ and then rotated 90° clockwise about the origin. Which of the following could be the result of this transformation?



37. A new temperature scale T is designed so that a temperature of 0°T is equivalent to a temperature of -24°C on the Celsius scale. If every increase of 5 degrees on the T scale is equivalent to an increase of 8 degrees on the Celsius scale, what is the temperature on the T scale that is equivalent to a temperature of 80°C ?

- (A) 40°T
- (B) 48°T
- (C) 65°T
- (D) 80°T

38. At how many points in the xy -plane do the graphs of

$$y = 0.25x^4 + 0.4x^3 - 1.2x^2 - 0.75x - 0.25$$

and $y = 0.5x - 2$ intersect?

- (A) None
- (B) Two
- (C) Three
- (D) Four

39. A six-sided number cube is weighted so that the probabilities of throwing 2, 3, 4, 5, or 6 are equal and the probability of throwing a 1 is twice the probability of throwing a 2. If the number cube is thrown twice, what is the probability that the sum of the numbers thrown will be 4 ?

(A) $\frac{1}{12}$

(B) $\frac{5}{49}$

(C) $\frac{3}{7}$

(D) $\frac{5}{11}$

40. The function $y = f(x) \cdot g(x)$, where

$$f(x) = x \text{ and } g(x) = \begin{cases} -1 & \text{if } x < 0 \\ 0 & \text{if } x = 0, \\ 1 & \text{if } x > 0 \end{cases}$$

is equivalent to which of the following functions?

- (A) $y = f(x)$
- (B) $y = f(-x)$
- (C) $y = -|f(x)|$
- (D) $y = f(|x|)$

Question Number	Key	Content Category	Question Number	Key	Content Category
1	B	Geometry	21	D	Data Analysis and Statistics
2	C	Discrete Mathematics	22	A	Geometry
3	C	Functions	23	C	Algebra and Number Theory
4	C	Data Analysis and Statistics	24	B	Calculus
5	D	Algebra and Number Theory	25	C	Geometry
6	B	Geometry	26	C	Matrix Algebra
7	C	Geometry	27	B	Discrete Mathematics
8	D	Trigonometry	28	C	Algebra and Number Theory
9	A	Matrix Algebra	29	A	Algebra and Number Theory
10	D	Calculus	30	D	Trigonometry
11	C	Discrete Mathematics	31	A	Data Analysis and Statistics
12	C	Geometry	32	B	Functions
13	B	Functions	33	A	Matrix Algebra
14	C	Measurement	34	C	Discrete Mathematics
15	D	Geometry	35	C	Functions
16	D	Probability	36	D	Geometry
17	D	Calculus	37	C	Measurement
18	A	Algebra and Number Theory	38	B	Functions
19	A	Functions	39	B	Probability
20	C	Algebra and Number Theory	40	D	Functions