2019 Enrolment The 1st

Japan University Examination

Mathematics (Arts)

Examination Date: November 2017

(90 min)

Do not open the examination booklet until the starting signal for the exam is given.
Please read the following instructions carefully.
Please fill in the examinee no. and name below.

Instructions

1. The booklet contains 5 pages.
2. The answer sheet is one piece of one sided paper.
3. In the case that you notice there are parts in the booklet where the print is not clear or there are missing pages or misplaced pages, or the answer sheet is soiled, raise your hand to report to the invigilator.
4. There are 4 questions to be answered.
5. Fill the examinee no. and name in the answer sheet.
6. Use black pencil to write answers in the designated section in the answer sheet.
7. Memos and calculations can be written on the examination booklet.
8. When the signal to end the exam is given, check again to see that the examinee no. and name is filled in and submit the answer sheet and the examination booklet according to the invigilator's instructions.

Examinee'sNo.	Name

[1] Fill in the following blanks from [A] to [D'] with numbers.

(1) If $\alpha = 1 + 2i$, $\beta = 1 - 2i$ (i is an imaginary number), then

$$\alpha + \beta = \boxed{A}, \alpha\beta = \boxed{B}, \quad \frac{5}{\alpha} + \frac{5}{\beta} = \boxed{C}$$

(2) a, b are both positive constants, if straight line

$$y = ax+b, \qquad \ldots(\ *\ )$$

goes through (*) point (3, 1), then

$b = \boxed{DE}\,a + \boxed{F}$

If $-1 \leqq x \leqq 1$, and the minimum value of y is -7, then

$a = \boxed{G}$, $b = \boxed{HI}$

The solution of the inequation

$$-1 < ax + b < 1$$

is

$$\boxed{J} < x < \boxed{K}$$

(3) Consider that $1 \leq n \leq 200$ (n is an integer), and assume two sets A and B as

Set A : n is multiple of 2

Set B : n is multiple of 3

The number of n that belongs to set A is [LMN],

and the number of n that belongs to set B is [OP],

Then the number of n that belongs to the sum of set A and set B is

[QRS].

(4) $\sin\theta\, 30° = \frac{\boxed{T}}{\boxed{U}}$, $\cos 120° = \frac{\boxed{VW}}{\boxed{X}}$

Consider that in triangle ABC, AB=3, AC=7, ∠ABC=90°。

Set ∠BAC=θ,

then $\sin\theta = \frac{\boxed{Y}\sqrt{\boxed{ZA'}}}{\boxed{B'}}$,

and $\sin(90° - \theta) = \frac{\boxed{C'}}{\boxed{D'}}$.

2 Fill in the following blanks from A to O' with numbers. P' is a multiple-choice .

(1) Consider that k is a real number. Straight line

$$y = k(x-3)+4 \qquad \ldots(*)$$

must go through point A (A , B) whatever the value of k is.

If straight line (*) intersects the y- axis at $y > 0$, then

$$k < \frac{C}{D}.$$

And, consider two points as point O(0, 0) and point B(−1,3). If straight line (*) intersects line segment OB (except point O and point B), then

$$\frac{E}{F} < k < \frac{G}{H}$$

(2) Consider a sequence $\{a_n\}$ as

$\{a_n\}$ 2, 7, 12, 17, 22, 27, …

Express the n^{th} item a_n in terms of n

$$a_n = \boxed{I}\,n - \boxed{J}$$

and

$$a_1 + a_2 + a_3 + \cdots + a_{100} = \boxed{KLMNO}$$

$$a_2 + a_4 + a_6 + \cdots + a_{100} = \boxed{PQRST}$$

(3) Consider that a is a positive real number. If the solution of equation

$$9^x - (a+1)\cdot 3^{x+1} + 8 = 0 \qquad \ldots(*)$$

is $x = 0$, then

$$a = \boxed{U}$$

Set $t = 3^x$, then (*) can be expressed as

$$t^2 - \boxed{V}\,t + \boxed{W} = 0,$$

$$t = \boxed{X},\ \boxed{Y}\ (\boxed{X} < \boxed{Y})$$

then, excluding $x = 0$, the solution of (*) is

$$x = \boxed{Z}\log_{\boxed{A'}}\boxed{B'}$$

(4) Consider that the equation

$$xy - 2x - 2y = 0 \qquad \cdots(\ *\ )$$

can be rewritten as

$$(x - \boxed{\text{C'}})(y - \boxed{\text{D'}}) = \boxed{\text{E'}}$$

So, a set of positive integers $x,\ y\ (x < y)$ satisfying (*) is

$$(x,\ y) = (\boxed{\text{F'}},\ \boxed{\text{G'}}).$$

(5) Consider m is a positive integer, circle C and straight line l are both on xy plane:

Circle C: $x^2 + y^2 - 6x + 8 = 0$, Straight line l: $y = mx - 1$

The centre of circle C is point A, and the radius is $r(> 0)$, then

$$\text{A}(\boxed{\text{H'}},\ \boxed{\text{I'}}),\ r = \boxed{\text{J'}}$$

Set the length of line segment drawn between point A and another point on straight line l is d, then minimum value of d is

$$d = \frac{|\boxed{\text{K'}}m - \boxed{\text{L'}}|}{\sqrt{m^2 + \boxed{\text{M'}}}}$$

When $d = r$, then

$$m = \frac{\boxed{\text{N'}}}{\boxed{\text{O'}}}$$

and the relationship of circle C and straight line l is $\boxed{\text{P'}}$. Please select a correct description of $\boxed{\text{P'}}$ from the following ①～③.

① Intersect in 2 different Points ② Tangent ③ Separate

3 Fill in the following blanks from A to S with numbers.

(1) Consider a is a constant, and the graph of quadratic equation

$y = -x^2 + (4a + 4)x - 3a^2 - 10a - 3$ is C.

Then the apex of C is

$$(\boxed{\text{A}}\, a + 2,\ a^2 - \boxed{\text{B}}\, a + 1)$$

and it is a parabola.

When $a = -2$, parabola C intersects the x-axis at

$$x = \boxed{\text{CD}},\ \boxed{\text{E}}.$$

(2) As the following figure, the length of side of the regular hexagon is 1, and number 0～5 are written on the 6 apex of the regular hexagon. Number 6 is written on the centre of the circumscribed circle of the regular hexagon.

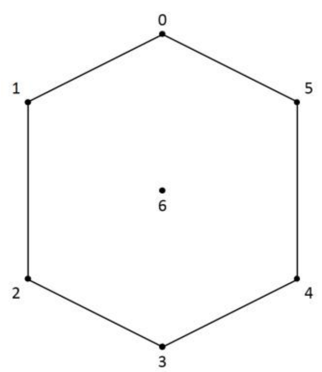
Here are 3 dices throw the 3 dices at the same time, and then pick out the numbers as the dices showed.

The probability that the 3 numbers which the dices showed are the same is $\frac{\boxed{\text{F}}}{\boxed{\text{GH}}}$.

The probability that 2 number among the 3 dices showed are the same is $\frac{\boxed{\text{I}}}{\boxed{\text{JK}}}$.

Then make a triangle by connecting the three selected points. However, the triangle may not be formed sometimes.

The probability that the 3 points constitute a regular triangle with a length of $\sqrt{3}$ is $\frac{\boxed{\text{L}}}{\boxed{\text{MN}}}$. The probability that the 3 points constitute a regular triangle is $\frac{\boxed{\text{O}}}{\boxed{\text{PQ}}}$. And the probability that the 3 points constitute a right-angled triangle is $\frac{\boxed{\text{R}}}{\boxed{\text{S}}}$.



4 Fill in the following blanks from [AB] to [O] with numbers.

In triangle ABC, $AB = 3\sqrt{10}$, $\cos\angle ABC = \frac{\sqrt{10}}{4}$.

Point His on side BC, BH: HC=3 :1, and AH is perpendicular to BC.

Then

$$BH = \frac{\boxed{AB}}{\boxed{C}}, \quad BC = \boxed{DE},$$

and

$$AC = \boxed{F}\sqrt{\boxed{GH}}, \quad \cos\angle BAC = \frac{\boxed{I}}{\boxed{J}}.$$

The radius of the circumscribed circle R of triangle ABC is

$$R = \frac{\boxed{K}\sqrt{\boxed{LM}}}{3}.$$

The angular bisector of ∠BAC intersects side BC at point D, then

$$BD = \boxed{N}, \quad AD = \boxed{O}$$