SAMPLE

Japan University Examination

Mathematics（Arts）

（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 7 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's No.	Name

$\boxed{1}$ Fill in the following blanks from $\boxed{\text{A}}$ to $\boxed{\text{W}}$ with the correct numbers.

(1) If the quadratic equation: $x^2 - 4x - 3 = 0$ has two roots, and the greater one is α, then

$$\alpha = \boxed{\text{A}} + \sqrt{\boxed{\text{B}}}$$

and if the integer part of α is a, the decimal part is b, then

$$a = \boxed{\text{C}},\ b - \frac{3}{b} = \boxed{\text{DE}}$$

(2) If $x = \frac{1}{\sqrt{3}+1}$, $y = \frac{1}{\sqrt{3}-1}$, then

$$x + y = \sqrt{\boxed{\text{F}}},$$

$$xy = \frac{\boxed{\text{G}}}{\boxed{\text{H}}},$$

$$x^2 + y^2 = \boxed{\text{I}}$$

(3) Both a and b are real numbers. The function named $f(x)$ can be described as

$$f(x) = ax+b$$

The straight line $y = f(x)$ goes through point $(-2,\ 3)$.

$$b = \boxed{\text{J}}\,a + \boxed{\text{K}}$$

If $1 \leqq x \leqq 2$, and the maximum of function $f(x)$ is 0, then

$$a = \boxed{\text{LM}},\ b = \boxed{\text{N}}$$

(4) Consider a triangle ABC with $\mathrm{AB} = 5$, $\mathrm{BC} = 2\sqrt{6}$, $\mathrm{CA} = 3$, then

$$\cos\angle\mathrm{BAC} = \frac{\boxed{\mathrm{O}}}{\boxed{\mathrm{P}}}$$

And let R be the radius of the circumcircle of ABC, then

$$R = \frac{\boxed{\mathrm{Q}}\sqrt{\boxed{\mathrm{R}}}}{\boxed{\mathrm{S}}}$$

(5) Both x and y are real numbers, and

$$2^x = 3,\ 4^y = 36$$

$$x = \log_2\boxed{\mathrm{T}},\ y = \log_2\boxed{\mathrm{U}}+\boxed{\mathrm{V}}$$

$\boxed{2}$ Fill in the following blanks from $\boxed{\text{A}}$ to $\boxed{\text{WX}}$ with the correct numbers.

(1) k is a real constant. Here is the equation for x

$$x^2 + 2(3 - 2k)x + k = 0 \qquad \ldots(*)$$

$(*)$ has equal root, then

$$k = \boxed{\text{A}},\ \frac{\boxed{\text{B}}}{\boxed{\text{C}}}$$

In this situation, if the equal root of $(*)$ is a negative number,

$$x = \boxed{\text{DE}}$$

(2) In the geometric series $\{a_n\}$, $a_5 = 48$, $a_9 = 768$, then

the first term $a_1 = \boxed{\text{F}}$, and the common ratio is $\boxed{\text{G}}$

and the n^th term a_n can be written as

$$a_n = \boxed{\text{H}} \cdot \boxed{\text{I}}^{\,n-\boxed{\text{J}}}$$

In this situation,

$$a_1 + a_2 + a_3 + \cdot\ \cdot\ \cdot + a_{10} = \boxed{\text{KLMN}}$$

(3) a is a real constant. When $0° \leqq \theta < 360°$, and one of the solutions of the equation for θ:

$$2\sin(\theta + 30°) = a \qquad \ldots(*)$$

is $\theta = 90°$, then

$$a = \sqrt{\boxed{\text{O}}}$$

In this situation, the other solution of $(*)$ (except for $\theta = 90°$) is

$$\theta = \boxed{\text{PQ}}°$$

(4) m is a real constant.

Circle C : $x^2 + y^2 - 2x - 8y + 13 = 0$

Straight line l : $mx - y + m - 3 = 0$

The coordinate of the centre of C is ($\boxed{\text{R}}$, $\boxed{\text{S}}$), and the radius is $\boxed{\text{T}}$.

In addition, C and l intersect at 2 different points, then

$$m > \frac{\boxed{\text{UV}}}{\boxed{\text{WX}}}$$

$\boxed{3}$ Fill in the following blanks from $\boxed{\text{ABC}}$ to $\boxed{\text{MN}}$ with the correct numbers.

There are 18 cards which are colored red, blue and yellow. Each color contains 6 cards which are numbered 1~6 .Once put the 18 cards into a bag and then take out 3 cards at the same time.

(1) There are $\boxed{\text{ABC}}$ different kinds of combinations of the 3 cards in total. If the 3 cards are all red, the kinds of combinations should be $\boxed{\text{DE}}$. Then if at least one of the 3 cards is numbered with 1, the kinds of combinations should be $\boxed{\text{FGH}}$.

(2) Suppose A and B represent the 2 cases below:

A : the 3 cards taken out are in the same color

B : the numbers on the 3 cards taken out are consecutive numbers

In addition, a, b fulfill the following conditions:

If A occurs, $a = 1$, and if A doesn't occur, $a = 0$

If B occurs, $b = 1$, and if B doesn't occur, $b = 0$

then,

The probability of $a = 1$ is $\dfrac{\boxed{\text{I}}}{\boxed{\text{JK}}}$, $b = 1$ is $\dfrac{\boxed{\text{L}}}{\boxed{\text{MN}}}$

$\boxed{4}$ Fill in the following blanks from $\boxed{\text{AB}}$ to $\boxed{\text{U}}$ with the correct numbers.

[1] a is a constant. Here are 2 inequalities for x

$x^2 - x - 2 > 0$ …①

$x^2 - (a+4)x + 4a \leqq 0$ …②

(1) The solution of inequality ① is

$x < \boxed{\text{AB}}$, $\boxed{\text{C}} < x$

(2) If there is only one real number of x that satisfy inequality ②, then

$a = \boxed{\text{D}}$

In this situation, the solution of inequality ② is

$x = \boxed{\text{E}}$

(3) There are 3 integers of x that satisfy both inequality ① and ②, so the range of a should be

$\boxed{\text{FG}} < a \leqq \boxed{\text{HI}}$, $\boxed{\text{J}} \leqq a < \boxed{\text{K}}$

[2] Make circle C with a rope which length is 12π. The radius of C is $\boxed{\text{L}}$, and the area is $\boxed{\text{MN}}\,\pi$. Then cut the rope into two parts, and make circle C_1, C_2 with each part.

Consider the radius of C_1 is x, and the radius of C_2 is y, then the perimeter of C_1 *and* C_2 are $\boxed{\text{O}}\,\pi x$, $\boxed{\text{O}}\,\pi y$, and

$$y = \boxed{\text{P}} - x$$

The sum of the area of C_1 and C_2 is S, then

$$S = 2\pi\left(x^2 - \boxed{\text{Q}}\,x + \boxed{\text{RS}}\right)$$

If the area S is two thirds of the area of C, then

$$x = \boxed{\text{T}} \pm \sqrt{\boxed{\text{U}}}$$