2017 Examination for Japanese University Admission for International Students

Mathematics (80 min.)

【Course 1 (Basic), Course 2 (Advanced)】

※ Choose one of these courses and answer its questions only.

I Rules of Examination

1. Do not leave the room without proctor's permission.
2. Do not take this question booklet out of the room.

II Instructions for the Question Booklet

1. Do not open this question booklet until instructed.
2. After being instructed, write your name and examination registration number in space provided below, as printed on your examination voucher.
3. Course 1 is on pages 1-13, and Course 2 is on pages 15-27.
4. If your question booklet is missing any pages, raise your hand.
5. You may write notes and calculations in the question booklet.

III Instructions for how to answer the questions

1. You must mark your answers on the answer sheet with an HB pencil.
2. Each letter **A**, **B**, **C**, $\cdots$ in the questions represents a numeral (from 0 to 9) or the minus sign($-$). When you mark your answers, fill in the oval completely for each letter in the corresponding row of the answer sheet (mark-sheet).
3. Sometimes an answer such as $\boxed{\text{A}}$ or $\boxed{\text{BC}}$ is used later in the question. In such a case, the symbol is shaded when it is used later, as $\boxed{\text{A}}$ or $\boxed{\text{BC}}$.

Note the following :

(1) Reduce square roots ($\sqrt{\ }$) as much as possible.
(Example: Express $\sqrt{32}$ as $4\sqrt{2}$, not as $2\sqrt{8}$ or $\sqrt{32}$.)

(2) For fractions, attach the minus sign to the numerator, and reduce the fraction to its lowest terms.
(Example: Substitute $\frac{1}{3}$ for $\frac{2}{6}$. Also simplify as follows:
$-\frac{2}{\sqrt{6}} = \frac{-2\sqrt{6}}{6} = \frac{-\sqrt{6}}{3}$. Then apply $\frac{-\sqrt{6}}{3}$ to the answer.)

(3) If your answer to $\dfrac{\boxed{\text{A}}\sqrt{\boxed{\text{B}}}}{\boxed{\text{C}}}$ is $\dfrac{-\sqrt{3}}{4}$, mark as shown below.

(4) If the answer to $\boxed{\text{DE}}\,x$ is $-x$, mark "$-$" for **D** and "1" for **E** as shown below.

A	●	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
B	⊖	⓪	①	②	●	④	⑤	⑥	⑦	⑧	⑨
C	⊖	⓪	①	②	③	●	⑤	⑥	⑦	⑧	⑨
D	●	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
E	⊖	⓪	●	②	③	④	⑤	⑥	⑦	⑧	⑨

4. Carefully read the instructions on the answer sheet, too.

※ Once you are instructed to start the examination, fill in your examination registration number and name.

Examination registration number			*					*						
Name														

Mathematics Course 1

(Basic Course)

(Course 2 begins on page 15)

Marking Your Choice of Course on the Answer Sheet

Choose to answer <u>either</u> Course 1 or Course 2.

If you choose Course 1, for example, circle the label “Course 1” and completely fill in the oval under the label on your answer sheet as shown in the example on the right.

< Example >

解答コース Course	
コース 1 Course 1	コース 2 Course 2
●	○

<u>**If you do not correctly fill in the appropriate oval, your answers will not be graded.**</u>

I

Q 1 Consider the quadratic function

$$y = 3x^2 - 6.$$

(1) Suppose that the graph obtained by a parallel translation of the graph of $y = 3x^2 - 6$ passes through the two points $(1, 5)$ and $(4, 14)$. The quadratic function of this graph is

$$y = \boxed{\mathsf{A}}\,x^2 - \boxed{\mathsf{BC}}\,x + \boxed{\mathsf{DE}}. \qquad \cdots\cdots\cdots \quad ①$$

This graph is the parallel translation of the graph of $y = 3x^2 - 6$ by $\boxed{\mathsf{F}}$ in the x-direction and by $\boxed{\mathsf{G}}$ in the y-direction.

(2) The quadratic function having the graph which is symmetric to the graph of $y = 3x^2 - 6$ with respect to the straight line $y = c$ is

$$y = -\boxed{\mathsf{H}}\,x^2 + \boxed{\mathsf{I}}\,c + \boxed{\mathsf{J}}. \qquad \cdots\cdots\cdots \quad ②$$

When the graphs of the two quadratic functions ① and ② have just one common point, it follows that $c = \boxed{\mathsf{K}}$, and the coordinates of the common point are $\left(\boxed{\mathsf{L}}, \boxed{\mathsf{M}}\right)$.

- memo -

Q 2 We have four white cards, three red cards and three black cards. A different number is written on each of the ten cards.

(1) Choose two of the ten cards and put one in box A, and one in box B. There are $\boxed{\mathbf{NO}}$ ways of putting two cards in the two boxes.

(2) There are $\boxed{\mathbf{PQ}}$ ways of choosing two cards of the same color, and $\boxed{\mathbf{RS}}$ ways of choosing two cards of different colors.

Next, put the ten cards in a box and take out one card and without returning it to the box, take out second card.

(3) The probability that the two cards taken out have the same color is $\dfrac{\boxed{\mathbf{T}}}{\boxed{\mathbf{UV}}}$.

(4) The probability that the color of the first card taken out is white or red, and the color of the second card taken out is red or black is $\dfrac{\boxed{\mathbf{WX}}}{\boxed{\mathbf{YZ}}}$.

- memo -

This is the end of the questions for Part $\boxed{\text{I}}$.

II

Q 1 Consider the real numbers a and b such that the equation in x

$$|x-3|+|x-6| = ax+b \qquad \cdots\cdots\cdots \quad ①$$

has a solution.

Set the left side of ① as $y=|x-3|+|x-6|$. This can be represented without using the absolute value signs in the following way.

If $x < \boxed{\mathsf{A}}$, then $y = -\boxed{\mathsf{B}}\,x+\boxed{\mathsf{C}}$;

if $\boxed{\mathsf{A}} \leqq x < \boxed{\mathsf{D}}$, then $y = \boxed{\mathsf{E}}$;

if $\boxed{\mathsf{D}} \leqq x$, then $y = \boxed{\mathsf{F}}\,x - \boxed{\mathsf{G}}$.

Next, let us consider the common point(s) of the graph of this function and the straight line $y=ax+b$ on the xy-plane. Then we see the following:

(i) If $a=1$, then the range of the values of b such that ① has one or more solutions is $b \geqq \boxed{\mathsf{HI}}$.

(ii) If $b=6$, then the range of the values of a such that ① has two different solutions is $\boxed{\mathsf{JK}} < a < \boxed{\mathsf{L}}$.

- memo -

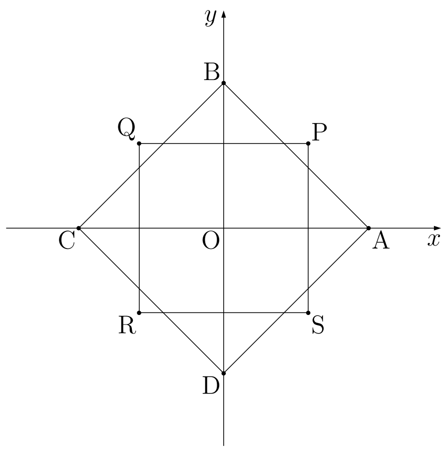
Q 2 Consider two squares as in the figure to the right.

Let the coordinates of their vertexes be

$$\mathrm{A}(2t, 0),\quad \mathrm{B}(0, 2t),\quad \mathrm{C}(-2t, 0),\quad \mathrm{D}(0, -2t),$$
$$\mathrm{P}(4-t^2, 4-t^2),\qquad \mathrm{Q}(-4+t^2, 4-t^2),$$
$$\mathrm{R}(-4+t^2, -4+t^2),\quad \mathrm{S}(4-t^2, -4+t^2),$$

where $0 < t < 2$.

Denote the areas of the two squares ABCD and PQRS by S_1 and S_2, respectively.



Then we have

$$S_1 = \boxed{\mathbf{M}}\, t^2 \quad \text{and} \quad S_2 = \boxed{\mathbf{N}} \left(t^2 - \boxed{\mathbf{O}}\right)^2.$$

(1) $S_1 + S_2$ is minimized at $t = \sqrt{\boxed{\mathbf{P}}}$, and the minimum value is $\boxed{\mathbf{QR}}$.

(2) For $\boxed{\mathbf{W}}$ and $\boxed{\mathbf{X}}$ below, choose the correct answer from among ⓪ ～ ⑨, and for the other $\boxed{}$, enter the correct numbers.

We are to find the range of t such that $S_1 < S_2$.

If $S_1 < S_2$, then t satisfies the inequality

$$t^4 - \boxed{\mathbf{ST}}\, t^2 + \boxed{\mathbf{UV}} > 0.$$

From the above inequality, a condition on t^2 is $\boxed{\mathbf{W}}$.

Hence, $S_1 < S_2$ if and only if t satisfies $\boxed{\mathbf{X}}$.

⓪ $t^2 < 4$ or $6 < t^2$　　① $4 < t^2 < 6$　　② $t^2 < 2$ or $8 < t^2$

③ $2 < t^2 < 8$　　④ $t^2 \neq 4$　　⑤ $0 < t < 2$

⑥ $0 < t < \sqrt{2}$　　⑦ $\sqrt{2} < t < 2$　　⑧ $2 < t < \sqrt{6}$

⑨ $t \neq 2$

- memo -

This is the end of the questions for Part $\boxed{\text{II}}$. Leave the answer spaces $\boxed{\textbf{Y}}$, $\boxed{\textbf{Z}}$ of Part $\boxed{\text{II}}$ blank.

III

Let n be a positive integer, and x and y be non-negative integers. We are to examine the solutions of the following equation in x and y

$$x^2 - y^2 = n. \qquad \cdots\cdots\cdots \quad ①$$

First of all, by transforming ①, we obtain

$$(x+y)(x-y) = n. \qquad \cdots\cdots\cdots \quad ②$$

(1) When we find the solutions (x, y) of ① in the cases where $n = 8$ and $n = 9$, we have that

if $n = 8$, then $(x, y) = (\boxed{\mathbf{A}}, \boxed{\mathbf{B}})$,

and

if $n = 9$, then $(x, y) = (\boxed{\mathbf{C}}, \boxed{\mathbf{D}}), (\boxed{\mathbf{E}}, \boxed{\mathbf{F}})$.

Note that you should write the solutions in the order such that $\boxed{\text{C}} < \boxed{\text{E}}$.

(This question is continued on the next page.)

(2) For each of $\boxed{\textbf{G}}$ ～ $\boxed{\textbf{R}}$ in the following sentences, choose the correct answer from among ⓪ ～ ⑨ given below.

The following is a proof that ③ given below is the necessary and sufficient condition for ① to have a solution.

Proof: First, suppose that (x, y) satisfies ①.

If x and y are both even or both odd, then both $x+y$ and $x-y$ are $\boxed{\textbf{G}}$. Hence, by ② we see that n is a multiple of $\boxed{\textbf{H}}$.

Next, if one of x and y is even and the other is odd, then both $x+y$ and $x-y$ are $\boxed{\textbf{I}}$, and hence n is $\boxed{\textbf{J}}$.

Thus we see that

"n is a multiple of $\boxed{\text{H}}$, or n is $\boxed{\text{J}}$" ········· ③

is a necessary condition for ① to have a solution.

Conversely, suppose that n satisfies the condition ③.

If n is a multiple of $\boxed{\text{H}}$, then n can be represented as $n = \boxed{\text{H}}\,k$, where k is a positive integer. So, if for example we take $x+y = \boxed{\textbf{K}}\,k$ and $x-y = 2$, then $(x, y) = (k + \boxed{\textbf{L}},\ k - \boxed{\textbf{M}})$, which shows that ① has a solution.

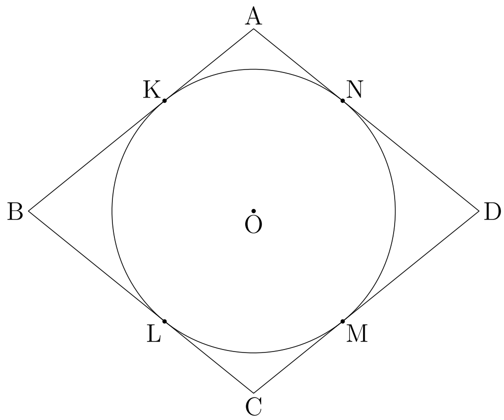
On the other hand, if n is $\boxed{\text{J}}$, then n can be represented as $n = \boxed{\textbf{N}}\,\ell + \boxed{\textbf{O}}$, where ℓ is a non-negative integer. So, if for example we take $x+y = \boxed{\textbf{P}}\,\ell + \boxed{\textbf{Q}}$ and $x-y = 1$, then $(x, y) = (\ell + \boxed{\textbf{R}}, \ell)$, which shows that ① has a solution.

From the above, we see that the necessary and sufficient condition for ① to have a solution is ③.

⓪ 0 ① 1 ② 2 ③ 3 ④ 4 ⑤ 5 ⑥ 6
⑦ even ⑧ odd ⑨ prime

This is the end of the questions for Part $\boxed{\text{III}}$. Leave the answer spaces $\boxed{\textbf{S}}$ ～ $\boxed{\textbf{Z}}$ of Part $\boxed{\text{III}}$ blank.

IV



Consider a rhombus ABCD with sides of length a, where a is a constant. Let r be the radius of the circle O inscribed in the rhombus ABCD, and K, L, M, N be the points of tangency of the circle O and the rhombus. Let S denote the area of the part of the rhombus outside circle O.

We are to find the range of the values of r, and the maximum value of S.

(1) For each of **A** ~ **C** below, choose the correct answer from among ⓪ ~ ⑨.

Let $\angle \mathrm{ABO} = \theta$. We have $\mathrm{OB} =$ **A**, and hence $\mathrm{OK} =$ **B**. Hence, since $(\cos\theta - \sin\theta)^2 \geqq 0$, the range of the values taken by r is

$$0 < r \leqq \boxed{\mathbf{C}}. \quad \cdots\cdots\cdots \quad ①$$

⓪ a ① $\dfrac{a}{2}$ ② $\dfrac{a}{3}$

③ $a\sin\theta$ ④ $a\cos\theta$ ⑤ $a\tan\theta$

⑥ $a\sin^2\theta$ ⑦ $a\cos^2\theta$ ⑧ $a\sin\theta\cos\theta$ ⑨ $a\tan^2\theta$

(This question is continued on the next page.)

(2) For each of $\boxed{\textbf{D}}$ ~ $\boxed{\textbf{F}}$ below, choose the correct answer from among ⓪ ~ ⑨.

When the area S is expressed in terms of r, we have

$$S = \boxed{\textbf{D}}.$$

Here, we observe that when $r = \boxed{\textbf{E}}$, the value of $\boxed{\text{D}}$ is maximized, and this value for r satisfies ①. Thus, at $r = \boxed{\text{E}}$, S takes the maximum value $\boxed{\textbf{F}}$.

⓪ $2ar - \pi r^2$ ① $ar - \dfrac{\pi}{2}r^2$ ② $\dfrac{a}{2}r - \pi r^2$ ③ $\dfrac{ar - \pi r^2}{2}$

④ $\dfrac{2a}{\pi}$ ⑤ $\dfrac{a}{\pi}$ ⑥ $\dfrac{a}{2\pi}$

⑦ $\dfrac{4a^2}{\pi}$ ⑧ $\dfrac{a^2}{\pi}$ ⑨ $\dfrac{a^2}{4\pi}$

This is the end of the questions for Part $\boxed{\text{IV}}$.

Leave the answer spaces $\boxed{\textbf{G}}$ ~ $\boxed{\textbf{Z}}$ of Part $\boxed{\text{IV}}$ blank.

This is the end of the questions for Course 1. Leave the answer spaces for Part $\boxed{\text{V}}$ blank.

Please check once more that you have properly marked your course number as "Course 1" on your answer sheet.

Do not take this question booklet out of the room.

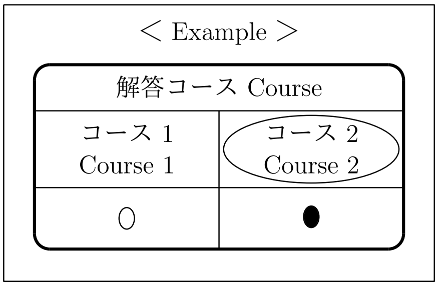
Mathematics Course 2

(Advanced Course)

Marking Your Choice of Course on the Answer Sheet

Choose to answer <u>either</u> Course 1 or Course 2.

If you choose Course 2, for example, circle the label "Course 2" and completely fill in the oval under the label on your answer sheet as shown in the example on the right.



<u>If you do not correctly fill in the appropriate oval, your answers will not be graded.</u>

I

Q 1 Consider the quadratic function

$$y = 3x^2 - 6.$$

(1) Suppose that the graph obtained by a parallel translation of the graph of $y = 3x^2 - 6$ passes through the two points $(1, 5)$ and $(4, 14)$. The quadratic function of this graph is

$$y = \boxed{\mathbf{A}}\,x^2 - \boxed{\mathbf{BC}}\,x + \boxed{\mathbf{DE}}. \qquad \cdots\cdots\cdots \quad ①$$

This graph is the parallel translation of the graph of $y = 3x^2 - 6$ by $\boxed{\mathbf{F}}$ in the x-direction and by $\boxed{\mathbf{G}}$ in the y-direction.

(2) The quadratic function having the graph which is symmetric to the graph of $y = 3x^2 - 6$ with respect to the straight line $y = c$ is

$$y = -\boxed{\mathbf{H}}\,x^2 + \boxed{\mathbf{I}}\,c + \boxed{\mathbf{J}}. \qquad \cdots\cdots\cdots \quad ②$$

When the graphs of the two quadratic functions ① and ② have just one common point, it follows that $c = \boxed{\mathbf{K}}$, and the coordinates of the common point are $\left(\boxed{\mathbf{L}}, \boxed{\mathbf{M}}\right)$.

- memo -

Q 2 We have four white cards, three red cards and three black cards. A different number is written on each of the ten cards.

(1) Choose two of the ten cards and put one in box A, and one in box B. There are $\boxed{\textbf{NO}}$ ways of putting two cards in the two boxes.

(2) There are $\boxed{\textbf{PQ}}$ ways of choosing two cards of the same color, and $\boxed{\textbf{RS}}$ ways of choosing two cards of different colors.

Next, put the ten cards in a box and take out one card and without returning it to the box, take out second card.

(3) The probability that the two cards taken out have the same color is $\dfrac{\boxed{\textbf{T}}}{\boxed{\textbf{UV}}}$.

(4) The probability that the color of the first card taken out is white or red, and the color of the second card taken out is red or black is $\dfrac{\boxed{\textbf{WX}}}{\boxed{\textbf{YZ}}}$.

- memo -

This is the end of the questions for Part $\boxed{\text{I}}$.

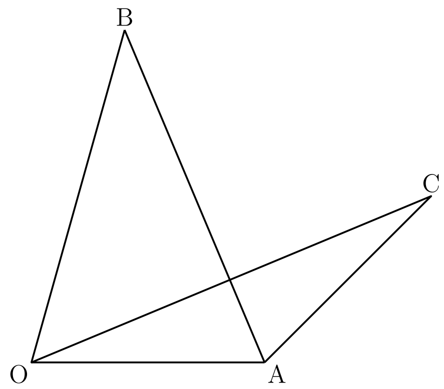
II

Q 1 A triangle OAB and a triangle OAC share one side OA, as in the figure to the right. Further, they satisfy the following two conditions:

(i) $\overrightarrow{\mathrm{OC}} = x\,\overrightarrow{\mathrm{OA}} + \dfrac{1}{2}\,\overrightarrow{\mathrm{OB}}$;

(ii) the center of the gravity G of the triangle OAC is on the segment AB.

We are to find the value of x, and express $\overrightarrow{\mathrm{OG}}$ in terms of $\overrightarrow{\mathrm{OA}}$ and $\overrightarrow{\mathrm{OB}}$.



Let us denote the point of intersection of the segment OC and the segment AB by D. Then we have

$$\overrightarrow{\mathrm{OD}} = \frac{x}{\boxed{\mathbf{A}}}\,\overrightarrow{\mathrm{OA}} + \frac{\boxed{\mathbf{B}}}{\boxed{\mathbf{C}}}\,\overrightarrow{\mathrm{OB}}.$$

Since D is on the segment AB, we have $x = \dfrac{\boxed{\mathbf{D}}}{\boxed{\mathbf{E}}}$.

Hence we obtain

$$\overrightarrow{\mathrm{OG}} = \frac{\boxed{\mathbf{F}}}{\boxed{\mathbf{G}}}\,\overrightarrow{\mathrm{OA}} + \frac{\boxed{\mathbf{H}}}{\boxed{\mathbf{I}}}\,\overrightarrow{\mathrm{OB}}.$$

In particular, when $\mathrm{OA} = 1$, $\mathrm{OB} = 2$ and $\angle\mathrm{AOB} = 60^\circ$, we have $\mathrm{OG} = \dfrac{\sqrt{\boxed{\mathbf{JK}}}}{\boxed{\mathbf{L}}}$.

- memo -

Q 2 Let z be a complex number satisfying $|z| = 2$. In the complex number plane with the origin O, let A and B be the points representing $1 + z$ and $1 - \frac{1}{2}z$, respectively.

First of all, we can express the complex number z as

$$z = \boxed{\mathbf{M}}\,(\cos\theta + i\sin\theta) \qquad (-\pi \leqq \theta < \pi).$$

(1) If z is not a real number, then the area S of the triangle OAB is $S = \boxed{\mathbf{N}}$. For $\boxed{\text{N}}$, choose the correct answer from among ⓪ ~ ⑧ below.

Hence, when $\theta = \pm\dfrac{\boxed{\mathbf{O}}}{\boxed{\mathbf{P}}}\pi$, S is maximized.

⓪ $\frac{1}{2}\left|\sin\left(\theta + \frac{1}{3}\pi\right)\right|$	① $\frac{1}{2}\,|\sin\theta|$	② $\frac{1}{2}\left|\sin\left(\theta - \frac{1}{3}\pi\right)\right|$
③ $\left|\sin\left(\theta + \frac{1}{3}\pi\right)\right|$	④ $|\sin\theta|$	⑤ $\left|\sin\left(\theta - \frac{1}{3}\pi\right)\right|$
⑥ $\frac{3}{2}\left|\sin\left(\theta + \frac{1}{3}\pi\right)\right|$	⑦ $\frac{3}{2}\,|\sin\theta|$	⑧ $\frac{3}{2}\left|\sin\left(\theta - \frac{1}{3}\pi\right)\right|$

(2) When the triangle OAB is an isosceles triangle where OA = OB, we see that

$$|1 + z| = \left|1 - \frac{1}{2}z\right| = \sqrt{\boxed{\mathbf{Q}}}$$

and

$$\arg(1 + z) = \pm\frac{\boxed{\mathbf{R}}}{\boxed{\mathbf{S}}}\pi, \quad \arg\left(1 - \frac{1}{2}z\right) = \mp\frac{\boxed{\mathbf{T}}}{\boxed{\mathbf{U}}}\pi,$$

where the right-hand sides of the equations are of opposite signs, and where $-\pi \leqq \arg(1 + z) < \pi$ and $-\pi \leqq \arg\left(1 - \frac{1}{2}z\right) < \pi$.

- memo -

This is the end of the questions for Part $\boxed{\text{II}}$. Leave the answer spaces $\boxed{\mathbf{V}}$ ～ $\boxed{\mathbf{Z}}$ of Part $\boxed{\text{II}}$ blank.

III

Consider the function $y = \dfrac{2^{x^2}}{5^{3x}}$, where $x \geqq 0$.

(1) We are to find the x at which y is minimized.

When we differentiate y, we have

$$\frac{dy}{dx} = \frac{2^{x^2}}{5^{3x}}\left(2x\log_e \boxed{\mathbf{A}} - \boxed{\mathbf{B}}\log_e \boxed{\mathbf{C}}\right).$$

Hence, when we express the value of x at which y is minimized using the common logarithm, we have

$$x = \frac{\boxed{\mathbf{D}}\left(1 - \log_{10}\boxed{\mathbf{E}}\right)}{\boxed{\mathbf{F}}\log_{10}\boxed{\mathbf{G}}}.$$

(2) We are to find the smallest positive integer x satisfying $\dfrac{2^{x^2}}{5^{3x}} > 1000$.

From the inequality $y > 1000$, we obtain

$$x^{\boxed{\mathbf{H}}}\log_{10}\boxed{\mathbf{I}} - \boxed{\mathbf{J}}\,x\log_{10}\boxed{\mathbf{K}} - \boxed{\mathbf{L}} > 0. \quad \cdots\cdots\cdots \text{①}$$

When we solve the inequality ① using 0.3 as an approximate value for $\log_{10} 2 = 0.301\cdots$, we have

$$x > \frac{\boxed{\mathbf{M}} + \sqrt{\boxed{\mathbf{NO}}}}{\boxed{\mathbf{P}}}.$$

Hence, the smallest positive integer x satisfying $y > 1000$ is $\boxed{\mathbf{Q}}$.

- memo -

This is the end of the questions for Part $\boxed{\text{III}}$. Leave the answer spaces $\boxed{\textbf{R}}$ ～ $\boxed{\textbf{Z}}$ of Part $\boxed{\text{III}}$ blank.

IV

Consider the function $f(x) = x\sin^2 x$ on the interval $0 \leqq x \leqq \pi$. Let ℓ be the tangent to the curve $y = f(x)$ that passes through the origin, where ℓ is not the x-axis. We are to find the area S of the region bounded by the curve $y = f(x)$ and the tangent ℓ.

(1) For each of $\boxed{\textbf{A}}$ ~ $\boxed{\textbf{D}}$ in the following sentences, choose the correct answer from among ⓪ ~ ⑨ below.

When we denote the point of tangency of the curve $y = f(x)$ and the tangent ℓ by $(t, f(t))$, we have the equality $\boxed{\textbf{A}}$, since ℓ passes through the origin. Further, since

$$f'(t) = \boxed{\textbf{B}} + 2t\boxed{\textbf{C}},$$

the x-coordinate of the point of tangency is $t = \boxed{\textbf{D}}$.

⓪ $f(t) = tf'(t)$ ① $f'(t) = tf(t)$

② $\sin t$ ③ $\sin^2 t$ ④ $\cos^2 t$ ⑤ $\sin t\cos t$

⑥ $\dfrac{\pi}{2}$ ⑦ $\dfrac{\pi}{3}$ ⑧ $\dfrac{\pi}{4}$ ⑨ $\dfrac{\pi}{6}$

(This question is continued on the next page.)

(2) For each of $\boxed{\mathbf{E}}$ ～ $\boxed{\mathbf{G}}$ in the following sentences, choose the correct answer from among ⓪ ～ ⑨ below.

The antiderivative of the function $f(x)$ is

$$\int f(x)\,dx = \boxed{\mathbf{E}}\left(2x^2 - 2x\boxed{\mathbf{F}} - \boxed{\mathbf{G}}\right) + C,$$

where C is the integral constant.

⓪ $\frac{1}{8}$　① $\frac{1}{4}$　② $\frac{1}{2}$　③ 2　④ 4　⑤ 8

⑥ $\sin x$　⑦ $\cos x$　⑧ $\sin 2x$　⑨ $\cos 2x$

(3) Thus, the area S of the region bounded by the curve $y = f(x)$ and the tangent ℓ is

$$S = \frac{\boxed{\mathbf{H}}}{\boxed{\mathbf{IJ}}}\pi^{\boxed{\mathbf{K}}} - \frac{\boxed{\mathbf{L}}}{\boxed{\mathbf{M}}}.$$

This is the end of the questions for Part $\boxed{\text{IV}}$.

Leave the answer spaces $\boxed{\mathbf{N}}$ ～ $\boxed{\mathbf{Z}}$ of Part $\boxed{\text{IV}}$ blank.

This is the end of the questions for Course 2. Leave the answer spaces for Part $\boxed{\text{V}}$ blank.

Please check once more that you have properly marked your course number as "Course 2" on your answer sheet.

Do not take this question booklet out of the room.