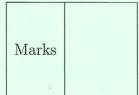
## MATHEMATICS(A)

(2014)

Nationality		No.	= 5	=
Name	(Please print full name, underlining family name)			Marks



1. Answer the following questions and fill in your responses in the corresponding boxes on the answer sheet.

(1) Let a and b be an integer part and an decimal fraction of  $\sqrt{7}$ , respectively. Then the integer part of  $\frac{a}{b}$  is [1-1].

(2) Consider a cone with a diameter of 12 and a height of 8. The volume of an inscribed sphere in the cone is [1-2].

(3)  $5^{29}$  is an integer with [1-3] places by assuming that  $\log_{10} 2 = 0.3010$ .

(4) There is a circle with a radius of 2 where the center is at the origin and a line 3x + 4y - 12 = 0 in the plane. The minimum distance between a point on the circle and a point on the line is 1-4.

(5) If the series  $\{a_k\}$  satisfies that  $a_1 = 1, a_2 = 2$ , and  $a_k - 4a_{k-1} + 3a_{k-2} = 0 \ (k \ge 3)$ , then  $a_k = \frac{1 + [1-5]}{[1-6]}$   $(k \ge 1)$ .

(6) Let f(x) = ax + b be a linear function. If the equation

$$\int_{-m/2}^{m} f(x)dx = \frac{m(m+1)}{2}$$

holds for any positive m, then  $f(x) = \frac{ [1-7] x + [1-8] }{3}$ .

- 2. Consider a semicircle with a diameter AB where the length is 4, and a point C on the circular arc. Answer the following questions and fill in your responses in the corresponding boxes on the answer sheet.
  - (1) The maximum of the area of the triangle ABC is [2-1].
  - (2) If the area of the triangle ABC is a half of the maximum and point C is nearer to point A than point B, then the angle  $\angle CAB$  is  $\boxed{[2-2]}$ .

3. Consider a function

$$y = \left(x^3 + \frac{1}{x^3}\right) - 6\left(x^2 + \frac{1}{x^2}\right) + 3\left(x + \frac{1}{x}\right)$$

defined in x > 0.

(1) Letting  $t = x + \frac{1}{x}$  gives

$$y = [3-1]t^3 + [3-2]t^2 + [3-3]t + [3-4]$$

Here it holds that

$$t = x + \frac{1}{x} \ge \boxed{[3-5]}.$$

(2) When t = [3-6], that is, x = [3-7], y has the minimum value [3-8].

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