平成22年度 入学者選抜学力試験（前期）

数　　　学

必須問題

I 以下の問いに答えよ．（配点 60 点）

　問 **1** $a > 0, b > 0$ に対して，次の命題が成り立つことを証明せよ．

$$a^2 - b^2 > 0 \quad \text{ならば} \quad a - b > 0 \quad \text{である．}$$

　問 **2** 実数 x, y が $xy > 0$ をみたすとき，不等式 $|x+y| > |x-y|$ を証明せよ．

II a を定数とするとき，関数 $f(x) = 2^{2x} - (4+a)2^{x+1} + 16a$ について，以下の問いに答えよ．（配点 60 点）

　問 **1** $a = -\dfrac{1}{2}$ のとき，$f(x) = 0$ をみたす x を求めよ．

　問 **2** $a > -4$ のとき，$f(x)$ の最小値を a で表せ．

III 3次関数 $f(x) = \dfrac{1}{3}x^3 - \dfrac{a}{2}x^2 - \dfrac{a^3}{12}$ について，以下の問いに答えよ．ただし，$a > 0$ とする．（配点 60 点）

　問 **1** $f(x)$ の極大値と極小値を求めよ．

　問 **2** f の導関数 $y = f'(x)$ のグラフの接線で，x 軸に平行なものを求めよ．

　問 **3** 問 2 で求めた接線と $y = f(x)$ のグラフが，共有点をちょうど 3 個もつような a の値の範囲を求めよ．

必須問題は，このページで終りである．

選択問題 (数学II・数学B)

I 以下の問いに答えよ. （配点 60 点）

問1 三角関数の加法定理を用いて，次の等式を証明せよ.

$$\sin\alpha - \sin\beta = 2\cos\frac{\alpha+\beta}{2}\sin\frac{\alpha-\beta}{2}$$

問2 次の不等式を証明せよ.

$$|\sin\alpha - \sin\beta| \leqq |\alpha - \beta|$$

必要ならば，実数 θ に対して成り立つ不等式 $|\sin\theta| \leqq |\theta|$ を用いてよい.

問3 数列 $\{a_n\}$ を，次の条件によって定める.

$$a_1 = \frac{\pi}{2}, \quad a_{n+1} = \frac{1}{2}\sin a_n + \frac{\pi}{2} \quad (\; n=1,\; 2,\; 3,\; \cdots\cdots\;)$$

このとき，次の不等式を証明せよ.

$$|a_{n+2} - a_{n+1}| \leqq \frac{1}{2}|a_{n+1} - a_n| \quad (\; n=1,\; 2,\; 3,\; \cdots\cdots\;)$$

問4 問3の数列 $\{a_n\}$ に対して，次の不等式を証明せよ.

$$|a_{n+1} - a_n| \leqq \left(\frac{1}{2}\right)^n \quad (\; n=1,\; 2,\; 3,\; \cdots\cdots\;)$$

II 座標平面上の直線 $y = x$ を ℓ とし，2 点 A $(1, 0)$, B $(2, 0)$ を考える．直線 ℓ 上を動く点を P (p, p) とする．また，$\overline{\mathrm{PQ}}$ は点 P と点 Q の間の距離を表すとする．このとき，以下の問いに答えよ．（配点 60 点）

問1 直線 ℓ 上のすべての点 P に対して，$\overline{\mathrm{PA}} = \overline{\mathrm{PC}}$ となるような y 軸上の動かない点 C の座標を求めよ．

問2 $\overline{\mathrm{PA}} + \overline{\mathrm{PB}}$ が最小となるような点 P の座標を求めよ．

問3 a は実数とする．直線 ℓ 上のすべての点 P に対して，

$$a \cdot \overline{\mathrm{PA}}^2 + (1 - a) \cdot \overline{\mathrm{PB}}^2 > 0$$

となるような a の値の範囲を求めよ．

数学Ⅱ・数学Ｂの問題は，このページで終りである．

選択問題 (数学Ⅲ・数学C)

Ⅰ 座標平面上の曲線 $y = e^x - 1$ を C とする．曲線 C と 2 直線 $y = 0,\ x = t$ で囲まれる部分の面積を S_1 とし，曲線 C と 2 直線 $y = 2,\ x = t$ で囲まれる部分の面積を S_2 とする．ただし，$0 < t < \log 3$ とする．このとき，以下の問いに答えよ．(配点 60 点)

　問1　$S_1 = S_2$ となるときの t の値を求めよ．

　問2　$S_1 + S_2$ が最小となるときの t の値を求めよ．

Ⅱ 行列 $A = \begin{pmatrix} 1 & -1 \\ a & 0 \end{pmatrix}$ について，以下の問いに答えよ．ただし，$a > 0$ とする．(配点 60 点)

　問1　A の逆行列を求めよ．

　問2　A の表す 1 次変換によって，双曲線 $y = \dfrac{1}{x-1}$ 上のある点が，点 $(-1, 1)$ に移されるとする．このとき，a の値を求めよ．

数学Ⅲ・数学Cの問題は，このページで終りである．

2010 Entrance Exam

平成 22 年度 入学者選抜学力試験 （前期）

English

英 語

注 意 事 項

1. 試験開始の合図があるまで，この問題冊子と解答冊子を開かないでください.

2. 問題は 1～9 ページにあります. ページ番号のついていない紙は下書き用紙です.

3. 解答冊子の表紙の所定欄に氏名と受験番号をはっきりと記入してください.

4. 試験中に問題冊子の印刷不明瞭，ページの落丁・乱丁および解答用紙の汚れ等に気がついた場合は，静かに手を上げて監督員に知らせてください.

5. 試験終了後，問題冊子は持ち帰ってください.

6. 解答時間は 90 分です.

7. 辞書を使用することができます.

8. 問題ごとに配点が記されています.

9. Part 1 の英文読解の問題の配点は 60 点です.

10. Part 2 から Part 5 の英作文の問題の配点は 140 点です.

Part 1 Reading Comprehension

Read the following article and answer the questions (1)–(6). (配点 60 点)

A library has traditionally been a place for archiving materials such as books, journals and published records. Recently libraries have been undergoing a remarkable transformation mainly due to the proliferation of digitized information on CD-ROMs, DVDs, and the World Wide Web.

Many years ago the role of the library was to store hand-written manuscripts and important documents. Thomas Frey of the daVinci Institute explains: ①"In medieval times, books were valuable possessions far too expensive for most people to own. As a result, libraries often turned into collections of lecterns with books chained to them."

Throughout history there have been many famous libraries. Alexandria in Egypt had the largest library in the ancient world with over 500,000 scrolls. Religious and scientific books of the Middle East were archived in Persepolis, Iran. The first library classification system for managing scrolls and books was implemented at an ancient library in China.

In order for ordinary people to look at books the government of the Roman Empire established the first public libraries over two thousand years ago. Over many centuries though, even these public libraries became the possession of the rich and powerful. However, a dramatic change occurred in the year 1455 when Johann Gutenberg invented the printing press. By 1500 over 500,000 books had been printed. Once again, the general public had access to information in text and pictures.

A modern transformation of libraries occurred around the end of the nineteenth century. Andrew Carnegie, an American philanthropist, provided money to build 2,509 libraries, of which 1,689 were built in the USA. As entrance to these libraries was free, books became more accessible to the general public.

Another remarkable transformation in the history of libraries is happening today. Progressive libraries include cafés, sofas, computers connected to the Internet, access to expensive databases of academic information, wireless access for personal devices such as laptops, and play areas for children. Libraries are also recognizing digital online

media such as audio Podcasts and YouTube videos, along with vast amounts of online text in Web pages or online journals. The ubiquity of technology in modern society is also allowing people to access information from computers and mobile phones from almost anywhere and at anytime. Consequently, no longer is information only available within the walls of a library building.

The Internet has certainly made people today much more informed than previous generations. However, people now complain of information overload. Subsequently, new skills for searching, managing and evaluating the information are required in this Digital Age. ②For example, searching the Internet for the population of Tokyo reveals not one single answer but many, different answers. Which answer is correct? Evaluating the sources of the information has become very important. One answer may be from the Tokyo Metropolitan Government Website, another answer may be from the Website 'citypopulations.com', and another answer could be from an environmental Website. The most reliable source, in this case, would be the Tokyo Metropolitan Government Website. However, you should not dismiss the other Websites as there are various methods for measuring the population of a city. In other words, the days of the one single, absolutely correct answer are over.

In conclusion, as technology develops rapidly so will access to information. Libraries of the future will therefore be very different. They will not only be spaces for quiet reading but vibrant spaces for active learning, information seeking and social interaction.

(1) この記事の標題として最も適切なものを，以下の選択肢の中から一つ選び，記号で答えよ．

   a. Libraries of the past.

   b. Libraries from the future.

   c. Libraries transforming with the times.

   d. Libraries as changeless institutions.

(2) この記事では，なぜ，正しい答えが一つだけの時代は終わったと述べているのか．その理由として最も適切なものを，以下の選択肢の中から一つ選び，記号で答えよ．

   a. There are over 500,000 books in print.

   b. There is now a lot of accessible information available.

   c. China, Egypt, Iran and USA are printing different books.

   d. The Tokyo Metropolitan Government provides the most reliable answers.

(3) この記事で述べられている，いつでも，どこからでも人々が情報にアクセスできるようになった理由として，最も適切なものを，以下の選択肢の中から一つ選び，記号で答えよ．

   a. Because a lot of information is on DVDs.

   b. Because information is contained within the walls of a library.

   c. Because many people have portable, networked technologies.

   d. Because Tokyo libraries are open seven days a week.

(4) この記事の内容に**合致しないもの**を，以下の選択肢の中から一つ選び，記号で答えよ．

   a. There were more than five hundred thousand scrolls in Alexandria.

   b. There were more than fifty thousand books printed by 1500.

   c. Johann Guternberg's press started printing in fourteen fifty.

   d. The Carnegie endowment enabled more than two thousand five hundred libraries to be built.

(5) | 下線部②を日本語に訳せ.

(6) | 下線部①"In medieval times, books were valuable possessions far too expensive for most people to own. **As a result**, libraries often turned into collections of lecterns with books chained to them." の中の 'As a result' の原因となったのは何か. 以下の選択肢の中から最も適切なものを一つ選び，記号で答えよ.

    a. Medieval times.

    b. Books people owned.

    c. Lecterns with books chained to them.

    d. The cost of books.

Part 2　Questions about a Japanese text

Read the following article and answer the questions (1) – (3) **in English**. (配点 30 点)

著作権保護のため問題文
（第 3 章「情報洪水の中で」の「4 インターネット」）
は省略してあります

（徳田雄洋「デジタル社会はなぜ生きにくいか」，岩波新書より）

(1) | According to the article, what are the characteristics of Internet Website access?

(2) | According to the article, what rule was discovered by the economist Pareto?

(3) | According to the article, describe a case in which access to the Internet becomes difficult.

Part 3   Opinions

The article in Part 1 showed that libraries are changing from quiet reading places to social spaces with cafés and multimedia.   Write one paragraph (between 60 to 90 words) with examples that support your personal opinion about this change. **(Write in English)** (配点 40 点)

Part 4　Explanatory Skills

The article in Part 1 showed that libraries have transformed over many centuries. Write one paragraph (between 60 to 90 words) explaining one good point and one bad point of a library you have used. **(Write in English)** (配点 40 点)

Part 5 Personal Response

The articles in Part 1 and Part 2 are about libraries and access to information. Think about your life and write one paragraph (between 60 to 90 words) describing how a library has helped you learn something. **(Write in English)**
(配点 30 点)