平成26年度　特別選抜(推薦)入試　基礎学力検査

数　　学

注 意 事 項

1. 基礎学力検査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. 問題は全部で4問あります（1ページ）.
3. 解答冊子の中には，解答用紙9枚と計算用紙が一緒にとじてあります．解答冊子のどのページも切り離してはいけません.
4. 解答冊子の表紙の所定欄に氏名（1箇所）と受験番号（2箇所）をはっきりと記入してください.
5. 基礎学力検査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.
6. 基礎学力検査終了後，問題冊子は持ち帰ってください.
7. 解答時間は90分です.
8. 設問ごとに配点が記されています.
9. 解答用紙には，答えだけでなく，結論に至る過程を必ず記述してください.

I 2 次方程式 $x^2-(3a+5)x+2a^2+9a+4=0$ を考える．ただし，定数 a は $0 \leqq a \leqq 1$ をみたすとする．この 2 次方程式の異なる 2 つの実数解を，α, β $(\alpha < \beta)$ で表すとき，以下の問いに答えよ．（配点 40 点）

問 1 $\alpha+\beta$ と $\alpha\beta$ をそれぞれ a で表せ.

問 2 $(\alpha-\beta)^2$ を a で表せ.

問 3 $\alpha^2-\beta^2$ の最小値と，そのときの a の値を求めよ.

II 2 つの関数 $f(x)=|x|-|x-1|,\ g(x)=ax+b$ について，以下の問いに答えよ．ただし，定数 a, b は実数とする．（配点 35 点）

問 1 $y=f(x)$ のグラフを描け.

問 2 $y=f(x)$ と $y=g(x)$ のグラフが $0<x<1$ においてただ 1 点で交わるとする．このとき，a と b がみたす関係式を求め，さらに点 (a, b) の存在する領域を図示せよ.

III 以下の問いに答えよ．（配点 35 点）

問 1 $27^x+2\cdot 9^x-5\cdot 3^x-6=0$ を解け.

問 2 $\log_2(x^3-3x^2-x+3)+\log_{\frac{1}{2}}(2x^2-7x+3)=0$ を解け.

IV 座標平面上において，$y=x^2$ で与えられる放物線 C 上に点 $\mathrm{P}(a, a^2)$ をとる．ただし，$a>0$ とする．また，点 P における放物線 C の接線を ℓ，点 P を通り ℓ と直交する直線を m とする．以下の問いに答えよ．（配点 40 点）

問 1 放物線 C と直線 m の共有点のうち，点 P と異なる点 Q の座標を求めよ.

問 2 放物線 C と直線 m で囲まれた図形の面積を S とする．S の最小値と，そのときの a の値を求めよ.

問題は，このページで終りである．

平成26年度 特別選抜(推薦)入試基礎学力検査

英語
100 点　60 分

注意事項

1. 基礎学力検査開始の合図があるまで, この問題冊子を開かないでください.
2. 問題冊子(問題は1~5ページにあります) と解答冊子(解答用紙2枚) は別々になっています. 解答冊子のみを提出してください.
3. 解答冊子の表紙に忘れずに氏名(1 箇所)と受験番号(2 箇所)をはっきり記入して下さい.
4. 基礎学力検査中に問題冊子や解答冊子の印刷上の問題などに気がついた場合は, 静かに手を挙げて監督員に知らせてください.
5. 辞書を使用することができます. また, 問題文は英語または日本語で書かれていますので, 指示を注意深く読んでから解答してください.
6. 設問ごとに配点が記されています.
7. 基礎学力検査終了後, 問題冊子は持ち帰ってください.

Part 1　Reading Comprehension

次の文章を読み, 以下の問いに答えよ. (配点 70 点)

In very basic terms, an inkjet printer creates a two-dimensional image by squirting ink from a print head onto a sheet of paper moving beneath it. Imagine a printer which can apply a thin layer of plastic instead of ink. The print head is programmed to move over a defined area in a precise sequence, adding layer upon layer of plastic where needed. As the layers build up a solid object is created. The technical name for this process, popularly known as 3D printing, is additive manufacturing. Additive manufacturing has been around for about thirty years, but it has only recently caught the imagination of the general public. It is a very exciting technology which has the potential to impact the world in many ways.

Additive manufacturing can fundamentally improve the design of things. Traditional manufacturing processes include cutting, moulding and joining; each has its own weaknesses and limitations. It is difficult to carve hollow shapes into solid objects, and joints often require additional weight and bulk. Additive manufacturing has no such compromises, because objects are created layer by layer from a base. It can easily create complex shapes. It is no more difficult or expensive to print a tangle of hollow plastic spaghetti than a simple cube. ①This has been praised as one of the most significant features of additive manufacturing (Lipson & Kurman, 2013) and allows for the redesign of myriad objects. Take the plaster cast, for example, which is a traditional treatment for broken bones. Although effective they are heavy, bulky and uncomfortable. Jake Evill, a young New Zealand designer, has created a prototype alternative using additive manufacturing. ②It is not only more effective at supporting the broken bone, but also "lightweight, washable, ventilated and recyclable" (Stinson, 2013) and has the potential to replace plaster casts completely.

Additive manufacturing is potentially less environmentally damaging than the current system of making things. Raw materials, components and products are often transported vast distances before reaching the consumer. In contrast, 3D printers can create a final product in a single step, removing the need to make individual components and assemble them in a factory. It means that companies can make their products much closer to their consumers. Furthermore, additive manufacturing makes more efficient use of raw materials, especially metals (yes, 3D printing with metal is possible). One way of making a complex-shaped metal object is to carve it from a solid block, resulting in significant waste. There is no such waste with additive manufacturing. Finally, researchers in the UK have demonstrated that it is possible to build concrete structures using additive manufacturing techniques (Le et al., 2012). Formwork and scaffolding are no longer needed, which results in significant environmental benefits.

As with any emerging technology, additive manufacturing is not without drawbacks. The easy availability of 3D printers, digital plans and plastic means that anyone can create, for example, a

gun. Although such guns are unreliable with current technology (James, 2013), many people are concerned. There are also ethical issues. Because additive manufacturing techniques can be applied with almost any material, some people are alarmed at research which aims to print human body parts using stem cell technology (Lipson & Kurman, 2013). These examples highlight the need for people to consider what should be made, not just what can be made.

Additive manufacturing is being used now. Did you know that Boeing's new 787 aircraft contains over 30 3D-printed parts (Lipson & Kurman, 2013)? Also, there is a lot of research being carried out on its further development and application. In the future, additive manufacturing will become commonplace, bringing many benefits but also some potential downsides.

References

James, M. (2013, May 25). 3D printing expert hoses down fears of homemade gun surge. *abc.net.au*. Retrieved August 22, 2013, from http://www.abc.net.au/news/2013-05-25/expert-hoses-down-fears-of-3d-gun-surge/4712886

Le, T. T., Austin, S. A., Lim, S., Buswell, R. A., Gibb, A. G. F., & Thorpe, T. (2012). Mix design and fresh properties for high-performance printing concrete. *Materials and Structures*, *45*(8), 1221-1232. doi:10.1617/s11527-012-9828-z

Lipson, H., & Kurman, M. (2013). *Fabricated: the new world of 3D printing*. Wiley. Retrieved from http://www.amazon.com/Fabricated-The-World-Printing-ebook/dp/B00B9V5W34/

Stinson, L. (2013, July 5). This 3D printed cast could be the future of healing broken bones. *wired.co.uk*. Retrieved August 22, 2013, from http://www.wired.co.uk/news/archive/2013-07/05/3d-printed-cast

(1) 本文で述べられている内容と一致するものを以下の選択肢より一つ選び, その記号を答えよ. (配点 10 点)

(ア) The benefits of additive manufacturing have been exploited for centuries.
(イ) 3D-printed spaghetti is delicious.
(ウ) Carving metal objects from solid blocks can be very wasteful.
(エ) Each Boeing 787 airplane has an inkjet printer on board.

(2) 本文の趣旨として最も適切なものはどれか. 以下の選択肢より一つ選び, その記号を答えよ. (配点 10 点)

(ア) to describe the history of additive manufacturing
(イ) to introduce additive manufacturing
(ウ) to explain why additive manufacturing has no real potential
(エ) to describe how to print your own gun using a design downloaded from the Internet

(3) 本文の表題として最も適切なものはどれか. 以下の選択肢より一つ選び, その記号を答えよ. (配点 10 点)

(ア) Plaster Casts have been Replaced by 3D-Printed Casts
(イ) Additive Manufacturing: A New but Irrelevant Technology
(ウ) 3D Printing has Transformed the Global Manufacturing Industry
(エ) Additive Manufacturing has an Exciting Future

(4) 下線部①の‘This’は何を指すか. 以下の選択肢より最も適切なものを一つ選び, その記号を答えよ. (配点 10 点)

(ア) the fact that a 3D printer can make both simple and complex shapes with the same effort and expense
(イ) the fact that a 3D printer can get tangled up in a bowl of spaghetti
(ウ) the fact that it is harder for a 3D printer to make a simple cube compared with a complex shape
(エ) the fact that it is very expensive for a 3D printer to make a complex shape out of plastic

(5) 本文によると，プラスチック以外にどの素材を additive manufacturing で使えるか．以下の選択肢より最も適切なものを一つ選び，その記号を答えよ．（配点 10 点）

(ア) spaghetti and plaster
(イ) plaster and glass
(ウ) silk and concrete
(エ) metal and concrete

(6) 本文によると，additive manufacturing のどのような特徴により，現在の製造技術に比べて環境への悪影響を小さくできると期待されているか．以下の選択肢より適切なものを一つ選び，その記号を答えよ．（配点 10 点）

(ア) Less spaghetti is wasted
(イ) It requires less transportation
(ウ) It doesn't need raw materials
(エ) More raw materials are wasted

(7) 下線部②の‘It’は何を指すか．以下の選択肢より最も適切なものを一つ選び，その記号を答えよ．（配点 10 点）

(ア) the fact that Jake Evill is from New Zealand
(イ) a traditional plaster cast
(ウ) a broken bone
(エ) Jake Evill's prototype cast

Part 2　Personal response to the writing

以下の問いに英語で答えよ．（配点 30 点）

What is a new technology that you know? Describe its good points and bad points. Write a paragraph (about 80 words) in English.