Divisão de Engenharia Civil

Programa de Pós-Graduação em Engenharia de Infra-Estrutura Aeronáutica

Prova de Seleção – 2º semestre de 2012 – Questões de Matemática

24 de maio de 2012

_____
Nome do Candidato

Observações

1. Duração da prova: 90 minutos (uma hora e meia)

2. Não é permitido o uso de calculadora

3. Cada pergunta admite uma única resposta

4. Marque a alternativa que considerar correta na tabela ao lado

5. Utilize o verso das folhas para a resolução das questões

Fórmulas Úteis

- Volume de uma esfera de raio R: $\frac{4}{3}\pi R^3$

- 2π rad $= 360°$

Questões em Português

1. Se $x \neq 0$ e $x = \sqrt{6xy - 9y^2}$, então, em termos de y, $x =$

   (a) $3y$
   (b) y
   (c) $y/3$
   (d) $\frac{-9x^2}{1-6y}$
   (e) $-3y$

Questão	Resp.
1	a
2	d
3	a
4	c
5	b
6	d
7	b
8	c
9	d
10	d
11	e
12	c
13	c
14	c
15	e
16	c

2. Em uma fábrica de cerveja, a máquina que enche as garrafas é capaz de encher 300 garrafas por hora, enquanto a máquina que tampa as garrafas é capaz de fazê-lo a uma taxa de 400 garrafas por hora. Em um certo dia, foram colocadas nas esteiras de produção 4500 garrafas. No entanto, a máquina de tampar as garrafas foi ligada duas horas e meia depois da máquina de encher garrafas. Depois de ligada a máquina de tampar as garrafas, quanto tempo foi necessário para todas as garrafas ficarem prontas?

   (a) 5 horas

   (b) 7,5 horas

   (c) 10 horas

   (d) 12,5 horas

   (e) 15 horas

3. Qual o intervalo (ou conjunto de intervalos) da reta real que satisfaz à inequação $x - 2 \leq \frac{2}{x-3}$?

   (a) $x \leq 1$ ou $3 < x \leq 4$

   (b) $1 \leq x < 3$ ou $x \geq 4$

   (c) $1 \leq x \leq 4$

   (d) $x \leq 1$ ou $x \leq 4$

   (e) Nenhuma das alternativas anteriores expressa o referido intervalo.

4. Na Figura 1, $CD = DA = AB$ e $CA = CB$. Logo, α vale

   (a) $24°$

   (b) $30°$

   (c) $36°$

   (d) $45°$

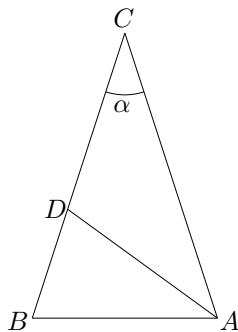   (e) não é possível calcular o valor de α.

Figura 1: Triângulo isósceles

5. Sobre sistema de equações

$$\begin{cases} y = \frac{1}{2}(3x^2 - 7x + 4) \\ y = \frac{1}{2}(3x^2 - 5x + 2) \\ t = 2 - x \end{cases}$$

pode-se afirmar que

(a) não possui solução real

(b) possui uma solução real

(c) possui duas soluções reais

(d) possui inúmeras soluções

(e) não é possível afirmar nada sobre quantas soluções ele possui, pois são necessárias informações adicionais

6. Em uma escola fundamental, a relação entre o número de meninos e o número de meninas é de $9 : 11$. O número total de crianças nesta escola é de 480. Em uma festa junina, qual o número mínimo de alunos ou alunas que terão que ficar sentados (sem par) na dança da quadrilha?

(a) 12

(b) 24

(c) 36

(d) 48

(e) 60

7. Paulo e Marcelo se revezaram no volante em uma viagem a um congresso a 150 quilômetros da cidade onde moram. Paulo dirigiu na ida, a uma velocidade média de 75 km/h. Marcelo dirigiu na volta, a uma velocidade média de 90 km/h. Qual a diferença, *em minutos*, entre os tempos de percurso de ida e de volta?

(a) 15

(b) 20

(c) 25

(d) 30

(e) 40

8. A equação $x^4 - 16 = 0$ possui

(a) 4 raízes reais e distintas

(b) 3 raízes reais e distintas

(c) 2 raízes reais e distintas

(d) uma raiz real

(e) nenhuma raiz real

Questões em Inglês

9. In Figure 2, the square region is divided into four nonoverlapping triangular regions. If the area of the square region is 9, what is the sum of the perimeters of the four triangular regions?

   (a) 12

   (b) $12 + 6\sqrt{2}$

   (c) 24

   (d) $12 + 12\sqrt{2}$

   (e) $24\sqrt{2}$

10. If arc in Figure 3 is a semicircle and given the following statements,

    I) $a = 9$

    II) $b = 4$

    what could be said about the length of PR?

    (a) statement (I) *alone* is sufficient, but statement (II) alone is not sufficient to answer the question asked;

    (b) statement (II) *alone* is sufficient, but statement (I) alone is not sufficient to answer the question asked;

    (c) *both* statements (I) and (II) *together* are sufficient to answer the question asked, but *neither* statement *alone* is sufficient;

    (d) *each* statement *alone* is sufficient to answer the question asked;

    (e) statements (I) and (II) *together* are *not* sufficient to answer the question asked, and additional data specific to the problem are needed.
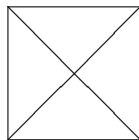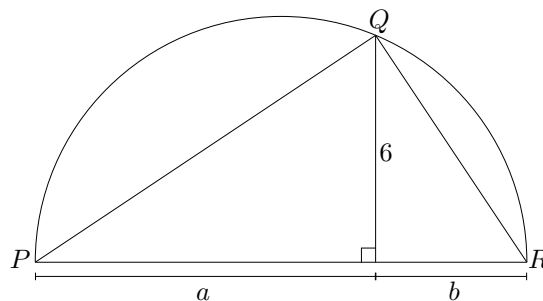

Figure 2: Square with diagonals

Figure 3: Semicircle

11. Which of the following *cannot* yield an integer when divided by 34?

    (a) The sum of two odd integers

    (b) An integer less than 34

    (c) The product of two primes

    (d) The sum of three consecutive integers

    (e) An odd integer

12. How many two-element subsets of 1,2,3,4,5 are there that do not contain elements 2 and 4?

    (a) One

    (b) Two

    (c) Three

    (d) Four

    (e) Six

13. The product of two numbers is $\frac{1}{30}$, while their inverses sum up 11. The modulus of their *difference* is

    (a) $\frac{1}{30}$

    (b) $\frac{5}{30}$

    (c) $\frac{11}{30}$

    (d) 1

    (e) 11

14. A solid sphere with radius r has two spherical void cavities inside it, both with raduis $\frac{r}{2}$. The ratio between the solid volume of this sphere and the volume of an entirely solid sphere is

    (a) $\frac{4}{3}$

    (b) $\frac{7}{8}$

    (c) $\frac{5}{6}$

    (d) $\frac{3}{4}$

    (e) $\frac{2}{3}$

15. On the faces of a regular die, the dots are arranged in such a way that the total number of dots on any two opposite faces is 7. If Figure 4 shows a regular die, what is the total number of dots on the faces that are not shown?

    (a) 7

    (b) 9

    (c) 10

    (d) 11

    (e) 12

16. Figure 4 shows a die with two faces leaned against a dihedron formed by a floor and a vertical wall. The distinct modes of leaning two faces of the die against that dihedron are in number of
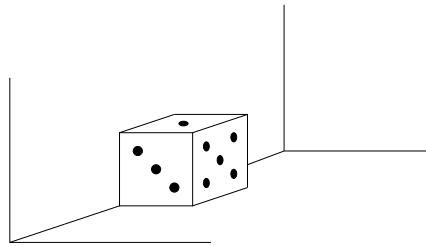
    (a) 6
    (b) 12
    (c) 24
    (d) 30
    (e) 36

Figure 4: A regular die

Programa de Pós-Graduação em Engenharia de Infra-Estrutura Aeronáutica

Prova de Seleção – 2º semestre de 2012 – Questão de Inglês

24 de maio de 2012

_____

Nome do Candidato

Observação

Duração da prova: 60 minutos

The Mistery of Being
(Texto para Tradução)

We each exist for but a short time, and in that time explore but a small part of the whole universe. But humans are a curious species. We wonder, we seek answers. Living in this vast world that is by turns kind and cruel, and gazing at the immense heavens above, people have always asked a multitude of questions: How can we understand the world in which we find ourselves? How does the universe behave? What is the nature of reality? Where did all this come from? Did the universe need a creator? Most of us do not spend most of our time worrying about these questions, but almost all of us worry about them some of the time.

Traditionally these are questions for philosophy, but philosophy is dead. Philosophy has not kept up with modern developments in science, particularly physics. Scientists have become the bearers of the torch of discovery in our quest for knowledge. The purpose of this book is to give the answers that are suggested by recent discoveries and theoretical advances. They lead us to a new picture of the universe and our place in it that is very different from the traditional one, and different even from the picture we might have painted just a decade or two ago. Still, the first sketches of the new concept can be traced back almost a century.

According to the traditional conception of the universe, objects move on well-defined paths and have definite histories. We can specify their precise position at each moment in time. Although that account is successful enough for everyday purposes, it was found in the 1920s that this "classical" picture

could not account for the seemingly bizarre behavior observed on the atomic and subatomic scales of existence. Instead it was necessary to adopt a different framework, called quantum physics. Quantum theories have turned out to be remarkably accurate at predicting events on those scales, while also reproducing the predictions of the old classical theories when applied to the macroscopic world of daily life. But quantum and classical physics are based on very different conceptions of physical reality.

Quantum theories can be formulated in many different ways, but what is probably the most intuitive description was given by Richard (Dick) Feynman, a colorful character who worked at the California Institute of Technology and played the bongo drums at a strip joint down the road. According to Feynman, a system has not just one history but every possible history. As we seek our answers, we will explain Feynman's approach in detail, and employ it to explore the idea that the universe itself has no single history, nor even an independent existence. That seems like a radical idea, even to many physicists. Indeed, like many notions in today's science, it appears to violate common sense. But common sense is based upon everyday experience, not upon the universe as it is revealed through the marvels of technologies such as those that allow us to gaze deep into the atom or back to the early universe.

Fonte: Hawking, S. and Mlodinov, L. (2010) *The Grand Design.* Bantam Books, New York, p.5-10
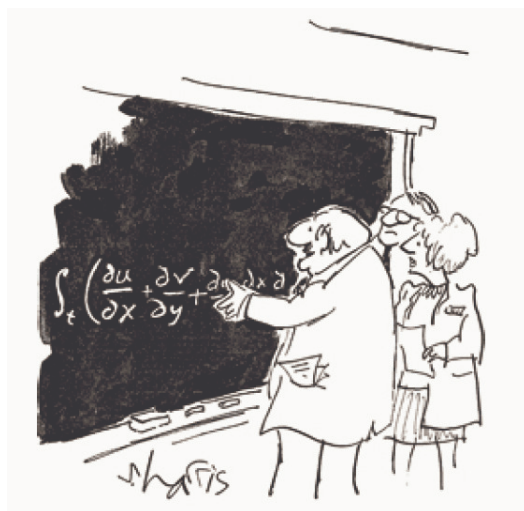

Figura 1: "... And *that* is my philosophy."