



Divisão de Engenharia Civil

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

Prova de Seleção – 1º semestre de 2013 – Questões de Matemática

25 de outubro de 2013

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

Questão	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Resp.	b	d	d	b	b	d	c	d	a	c	d	d	b	b	a	a

Questões em Português

1. Em uma pequena sala de aula, existem 10 alunos. 7 deles têm 12 anos de idade e 3 deles têm 13 anos. Tomando-se arbitrariamente 5 alunos desta sala, quantos valores diferentes podem ser atribuídos à soma das idades destes 5?
 - (a) 3
 - (b) 4
 - (c) $2^5 = 8$
 - (d) $\binom{3}{5} = 10$
 - (e) $\binom{5}{10} = 252$

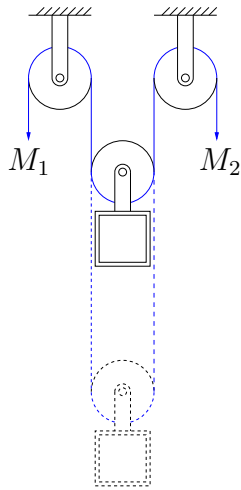


Figura 1: Elevador acionado por um dois motores

2. A Figura 1 mostra um pequeno elevador, que pode ser acionado por dois motores de passo M_1 e M_2 , através de duas polias. Quando apenas o motor M_1 é acionado, a segunda polia presa no teto permanece fixa e o elevador demora 21 segundos para subir. Quando os dois motores são acionados, o elevador sobe em 12 segundos. Supondo-se que a velocidade de cada motor é constante e independente da velocidade do outro, qual o tempo em segundos que o elevador vai demorar para subir quando apenas o motor M_2 é acionado?
- (a) 14 s
 (b) 18 s
 (c) 24 s
 (d) 28 s
 (e) 33 s
3. Um caixa automático possui disponíveis notas de R\$ 2,00, R\$ 5,00, R\$ 10,00, R\$ 20,00 para a realização de saques. De quantas formas pode-se sacar R\$ 30,00?
- (a) 10
 (b) 11
 (c) 12
 (d) 13
 (e) 14
4. Dois litros de salmoura contêm $NaCl$ em uma concentração de 100 g/l. Para se obter 3 litros de salmoura a uma concentração de 80 g/l, qual a concentração de $NaCl$ no litro de salmoura a ser adicionado?
- (a) 30 g/l
 (b) 40 g/l
 (c) 60 g/l
 (d) 80 g/l
 (e) 90 g/l

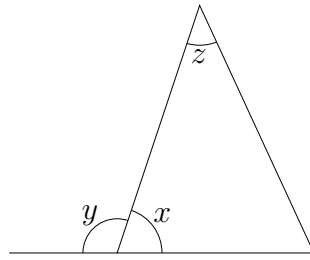


Figura 2: Triângulo com ângulo externo (figura esquemática, com proporções falsas).

5. Na Figura 2, $y = 2x$ e $y = 4z$. Qual o valor de z ?
- (a) 24°
 - (b) 30°
 - (c) 36°
 - (d) 54°
 - (e) 60°
6. Qual a probabilidade da soma dos resultados de dois lançamentos de um dado comum (não viciado) resultar 3?
- (a) $\frac{1}{3}$
 - (b) $\frac{1}{6}$
 - (c) $\frac{1}{12}$
 - (d) $\frac{1}{18}$
 - (e) $\frac{1}{36}$
7. Uma bandeira de cartão de crédito permite o acúmulo integral de uma dívida por até quatro meses, sem pagamento de amortização mínima. Para esta situação, são cobrados juros compostos a uma taxa de 10% ao mês. Nestas condições, quais seriam os juros acumulados ao final de quatro meses sem pagamento da dívida inicial?
- (a) 40,00 %
 - (b) 44,00 %
 - (c) 46,41 %
 - (d) 110,00 %
 - (e) 140,00 %
 - (f) Nenhuma das alternativas anteriores.

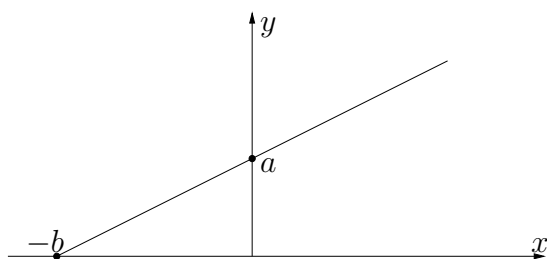


Figura 3: Reta no plano cartesiano

8. Na Figura 3, $a = 1$ e $b = 2$. A equação da reta mostrada na figura será:

- (a) $y = 1 + 2x$
- (b) $y = \frac{1}{2}x - 1$
- (c) $y = \frac{1}{2}x$
- (d) $y = 1 + \frac{1}{2}x$
- (e) $y = 1 - \frac{1}{2}x$

Questões em Inglês

9. If 12 inches equal 1 foot, how many square feet does 1 square inch equal?
- (a) 0.006944444...
 - (b) 0.083333333...
 - (c) 1
 - (d) 12
 - (e) 144
10. The product of three numbers is 72 while their sum is 13. If one of that numbers is 6, the other ones are
- (a) 2 and 4
 - (b) 2 and 6
 - (c) 3 and 4
 - (d) 4 and 6
 - (e) 7 and 12
11. Mark the option that contains *all* roots of $|x^2 - 4| - x = 2$:
- (a) -2 and 1
 - (b) -2 and 3
 - (c) 1 and 3
 - (d) -2, 1 and 3
 - (e) This equation cannot be solved.

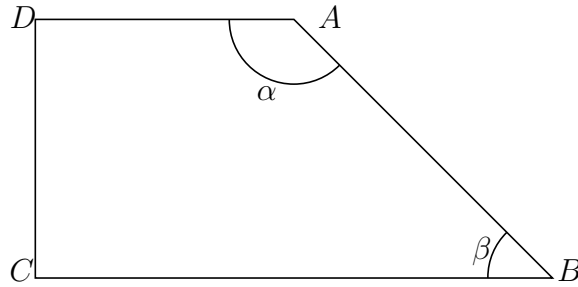


Figure 4: Trapezoid

12. Regarding the trapezoid in Figure 4, the following information is given:

- (I) $\beta = 45^\circ$
- (II) $CD = DA = 2, BC = 4$.

Can we determine the sum $\alpha + \beta$?

- (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) *neither* statement (I) nor statement (II) is necessary 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.

13. If $y \neq z$ and $x \neq 0$, $\frac{z - y}{xy - zx} = ?$

- (a) -1
- (b) $-\frac{1}{x}$
- (c) $\frac{1}{x}$
- (d) 1
- (e) x

14. A company profits have tripled in the 4 years it has been in existence. If the total profits for the last 4 years were \$ 80 million, what were the profit in the first year of operation?

- (a) \$ 1,000,000.00
- (b) \$ 2,000,000.00
- (c) \$ 6,666,666.66
- (d) \$ 10,000,000.00
- (e) \$ 20,000,000.00

15. When two unbiased dices are throw, what is que probability of the sum of the square of their results beig less or equal to 10?

- (a) $\frac{1}{12}$
- (b) $\frac{1}{9}$
- (c) $\frac{1}{6}$
- (d) $\frac{1}{4}$
- (e) $\frac{5}{2}$

16. About an unknown number x , the following information is given::

- (I) $x < \frac{x}{2}$
- (II) $x - 2$ is negative.

Is x a positive number?

- (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;
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Observação

Duração da prova: 60 minutos

A universe from nothing (Preface)

In the interests of full disclosure right at the outset I must admit that I am not sympathetic to the conviction that creation requires a creator, which is at the basis of all of the world's religions. Every day beautiful and miraculous objects suddenly appear, from snowflakes on a cold winter morning to vibrant rainbows after a late-afternoon summer shower. Yet no one but the most ardent fundamentalists would suggest that each and every such object is lovingly and painstakingly and, most important, purposefully created by a divine intelligence. In fact, many laypeople as well as scientists revel in our ability to explain how snowflakes and rainbows can spontaneously appear, based on simple, elegant laws of physics.

Of course, one can ask, and many do, “Where do the laws of physics come from?” as well as more suggestively, “Who created these laws?” Even if one can answer this first query, the petitioner will then often ask, “But where did that come from?” or “Who created that?” and so on.

Ultimately, many thoughtful people are driven to the apparent need for First Cause, as Plato, Aquinas, or the modern Roman Catholic Church might put it, and thereby to suppose some divine being: a creator of all that there is, and all that there ever will be, someone or something eternal and everywhere.

Nevertheless, the declaration of a First Cause still leaves open the question, “Who created the creator?” After all, what is the difference between arguing in favor of an eternally existing creator versus an eternally existing universe without one? These arguments always remind me of the famous story of an expert giving a lecture on the origins of the universe (sometimes identified as Bertrand Russell and sometimes William James), who is challenged by a woman who believes that the world is held up by a gigantic turtle, who is then held up by another turtle, and then another. . . with further turtles “all the way down!” An infinite regress of some

creative force that begets itself, even some imagined force that is greater than turtles, doesn't get us any closer to what it is that gives rise to the universe. Nonetheless, this metaphor of an infinite regression may actually be closer to the real process by which the universe came to be than a single creator would explain.

Defining away the question by arguing that the buck stops with God may seem to obviate the issue of infinite regression, but here I invoke my mantra: The universe is the way it is, whether we like it or not. The existence or nonexistence of a creator is independent of our desires. A world without God or purpose may seem harsh or pointless, but that alone doesn't require God to actually exist.

Similarly, our minds may not be able to easily comprehend infinities (although mathematics, a product of our minds, deals with them rather nicely), but that doesn't tell us that infinities don't exist. Our universe could be infinite in spatial or temporal extent. Or, as Richard Feynman once put it, the laws of physics could be like an infinitely layered onion, with new laws becoming operational as we probe new scales. *We simply don't know!*

Fonte: Lawrence M. Kraus (2012) *A Universe from Nothing – why there is something rather than nothing*. Free Press, New York, p.xi-xii