

Nome: _____

Candidato ao mestrado

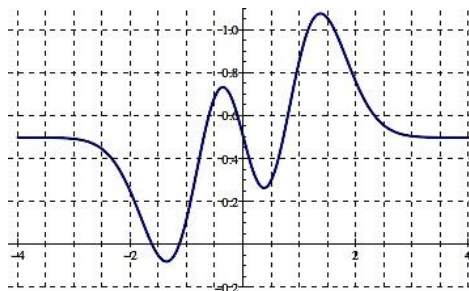
ao doutorado

Data: 21/09/2012

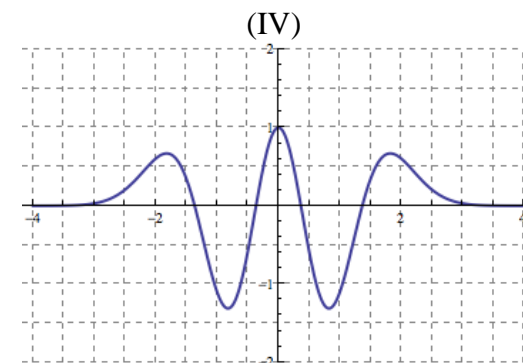
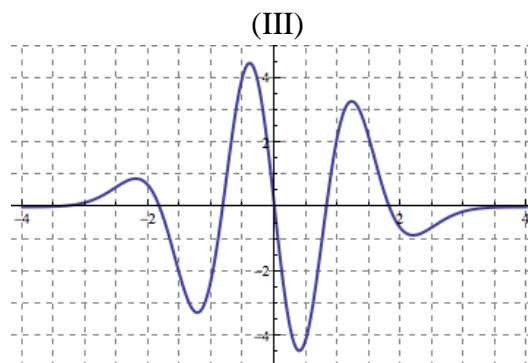
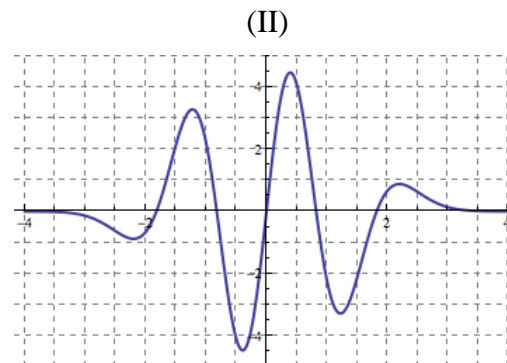
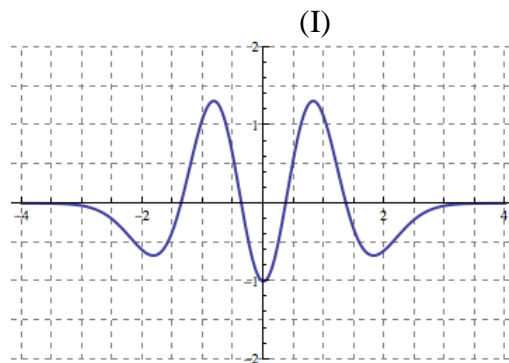
Prova escrita da Segunda Seleção para Mestrado e Doutorado de 2012

Matemática

1- Considere a função $f(x)$ abaixo:



Analise os gráficos das funções abaixo e marque a alternativa com a indicação correta dos gráficos da primeira derivada e da segunda derivada da função $f(x)$.



$$\begin{array}{l} \text{a) III} - f'(x) \\ \text{I} - f''(x) \end{array}$$

$$\begin{array}{l} \text{b) II} - f'(x) \\ \text{III} - f''(x) \end{array}$$

$$\begin{array}{l} \text{c) IV} - f'(x) \\ \text{I} - f''(x) \end{array}$$

$$\begin{array}{l} \text{d) III} - f'(x) \\ \text{IV} - f''(x) \end{array}$$

$$\begin{array}{l} \text{e) I} - f'(x) \\ \text{II} - f''(x) \end{array}$$

2- A função $f(x)$ é definida como

$$f(x) = \int_0^x e^{-g^2} \cos(g) \, dg .$$

Analise as seguintes afirmativas sobre esta função:

$$\text{I-} \quad \lim_{x \rightarrow \infty} f(x) = 0$$

$$\text{II-} \quad f(-1) = -f(1)$$

$$\text{III-} \quad f(0) = 0$$

$$\text{IV-} \quad f\left(\frac{\pi}{2}\right) > f(\pi)$$

São verdadeiras somente as alternativas

- a) I e II
- b) II e III e IV
- c) III e IV
- d) I e IV
- e) I, II e III

Dica: Não tente resolver a integral.

3- Analise os seguintes sub-conjuntos do \mathbf{R}^3 , formados por vetores da forma $\begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix}$.

I – O plano dos vetores com $a_1 = a_2$.

II – O plano dos vetores com $a_1 = 1$.

III – Todos os vetores que satisfazem $a_1 + a_2 + a_3 = 0$.

IV – Todos os vetores com $a_1 a_2 a_3 = 0$.

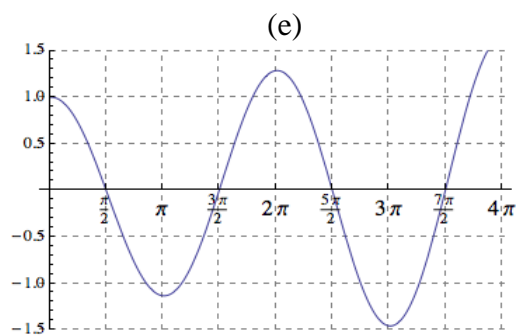
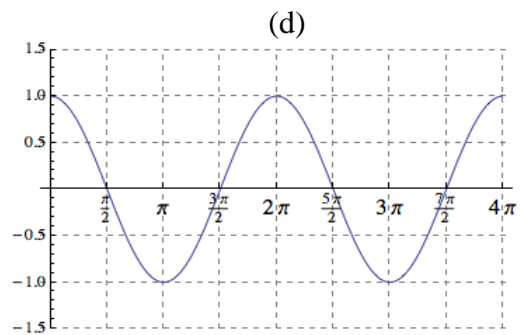
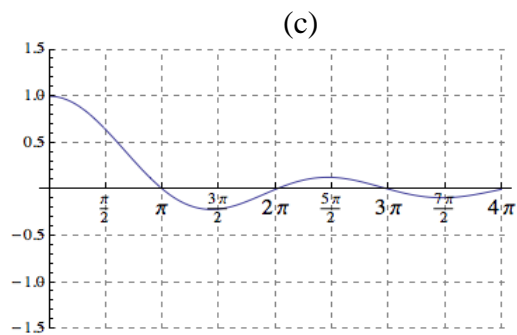
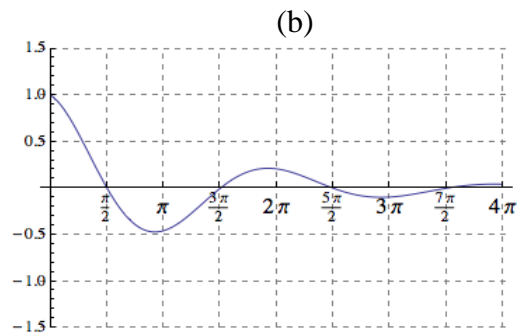
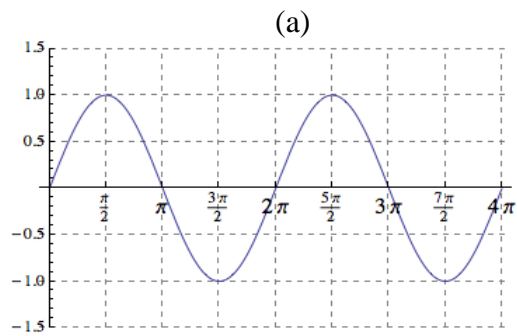
Destes, são sub-espços vetoriais apenas os conjuntos

- a) I e II
- b) I e III

- c) II e IV
- d) III e IV
- e) II, III e IV

4- Marque a alternativa com o gráfico da função-solução da seguinte equação diferencial:

$$\begin{cases} \frac{d^2 u(x)}{dx^2} = -u(x) \\ u(0) = 1 \\ u'(0) = 0 \end{cases}$$



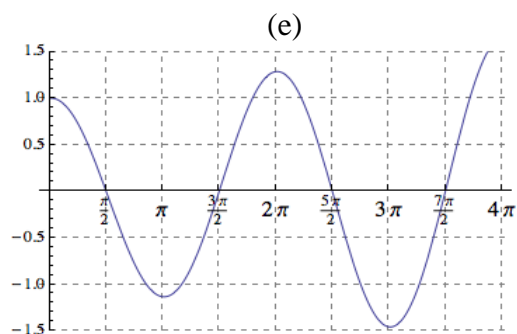
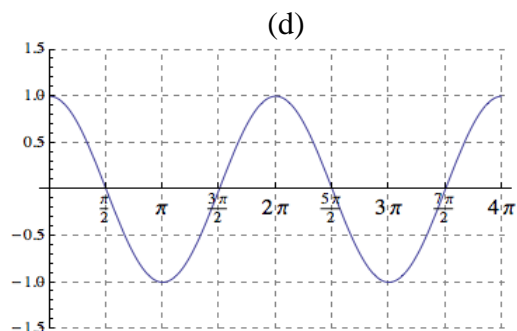
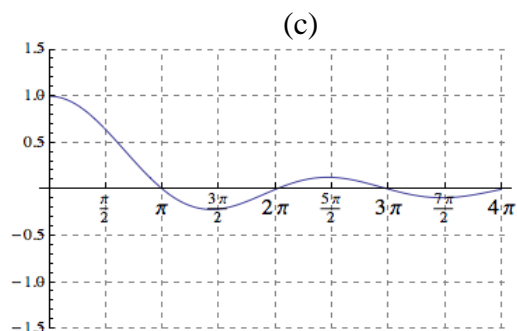
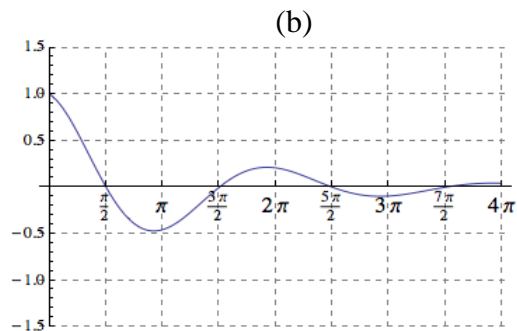
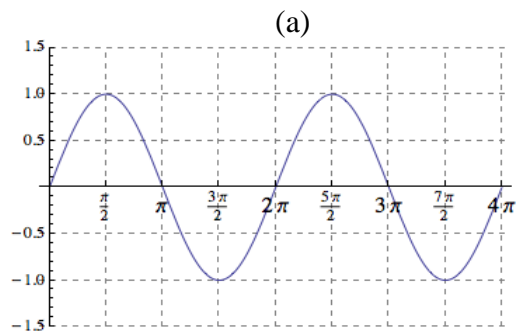
5- A função $f(x)$ é definida da seguinte maneira:

$$i = \sqrt{-1},$$

$$z(x) = \left(-\frac{1}{4} + i\right)x,$$

$$f(x) = e^{z(x)}.$$

Indique qual dos gráficos representa a parte real desta função.



Física

6 - Uma pedra é lançada verticalmente para cima. Durante a subida ela passa por um ponto A com velocidade v e por um ponto B (3,00 m acima de A) com velocidade $v/2$. A velocidade v é:

- a) 10 m/s
- b) 12,4 m/s
- c) 9,8 m/s
- d) 11 m/s

e) 8,85 m/s

7 - Uma folha plana infinita encontra-se no plano $z = 0$ e carrega uma corrente de densidade uniforme

$$\mathbf{J}_x = (-0.1 \cos \omega t \mathbf{a}_x + 0.1 \sin \omega t \mathbf{a}_y) \text{ A/m}$$

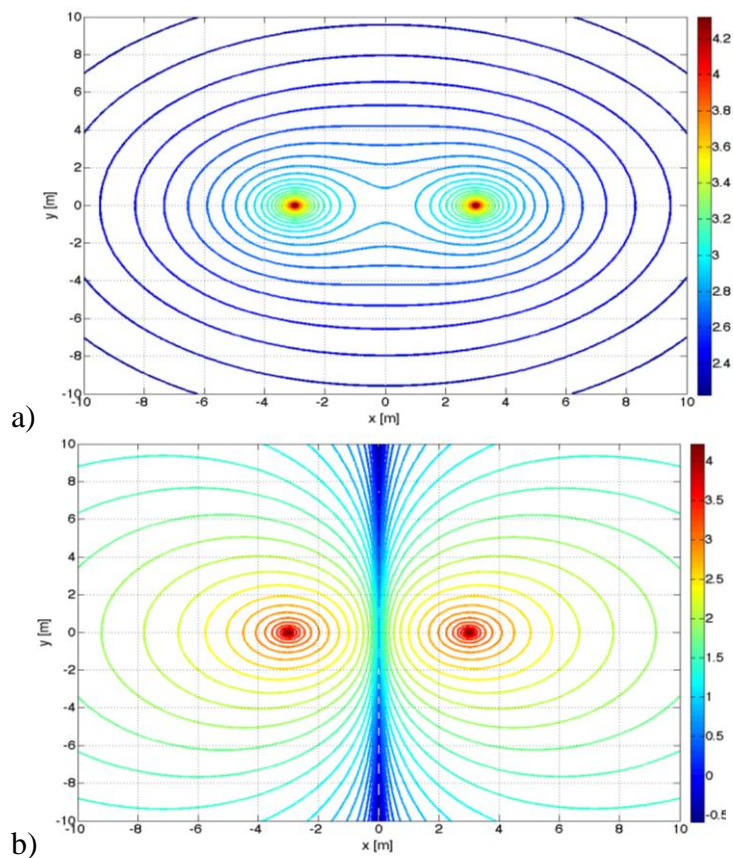
Encontre a corrente que atravessa a linha reta que passa pelos pontos $(0; 0; 0)$ e $(2; 0; 0)$

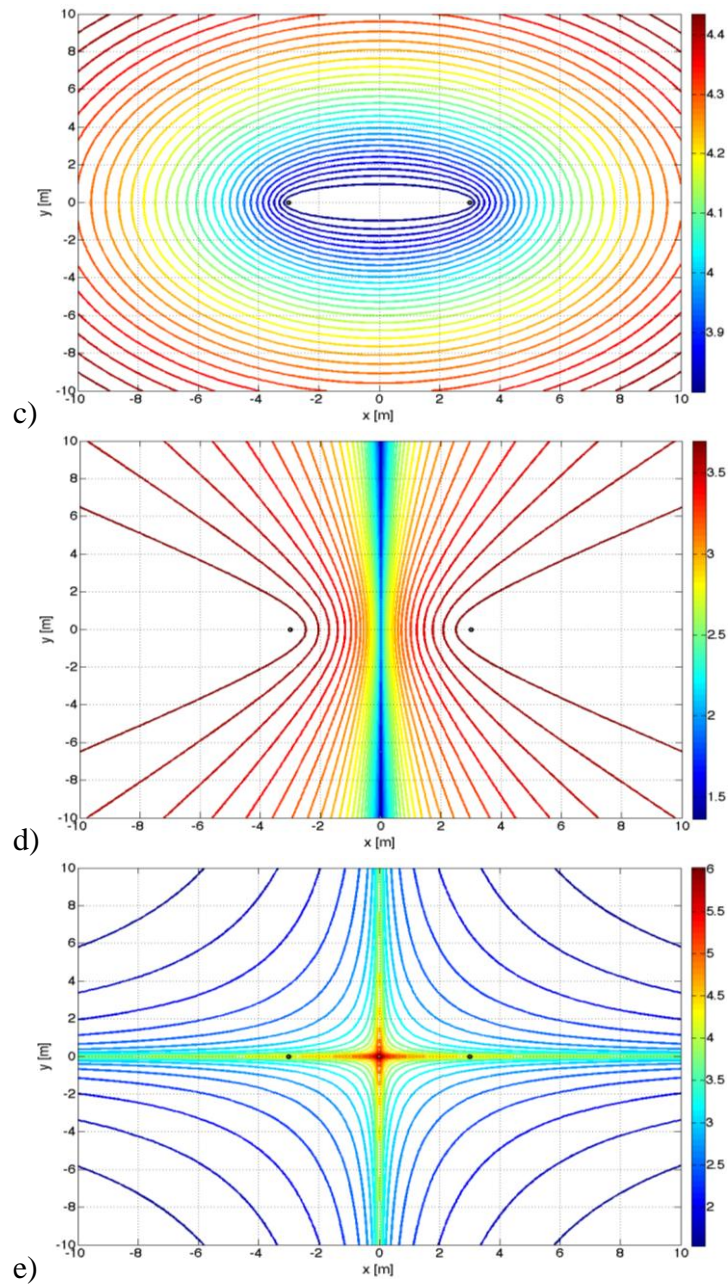
- (a) $0.1 \sin \omega t \text{ A}$
- (b) $-0.1 \cos \omega t \text{ A}$
- (c) $0.2 \sin \omega t \text{ A}$
- (d) $-0.2 \cos \omega t \text{ A}$
- (e) 0 A

8- O potencial gravitacional de uma massa M em um ponto r é dado por:

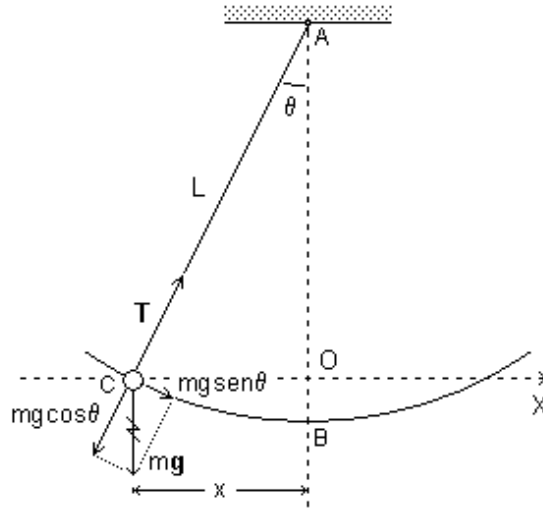
$$\Phi(r) = -G \frac{M}{|r - r_0|}$$

em que r_0 representa a posição da massa. Considere duas massas pontuais M , localizadas nos pontos $P_1 = (-3, 0)$ e $P_2 = (3, 0)$, respectivamente. Qual dos gráficos abaixo melhor representa a intensidade das superfícies equipotenciais resultante destas duas massas?





9 - Qual das equações diferenciais abaixo representa o movimento do pêndulo simples como o da Figura, para pequenas amplitudes?



a) $\frac{d^2\theta}{dt^2} + \frac{g}{l}\theta = P$ (P é o peso)

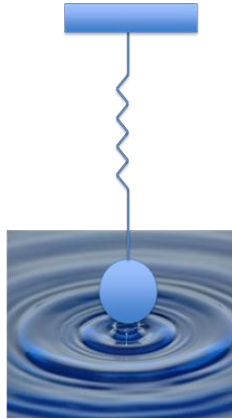
b) $\frac{d^2\theta}{dt^2} + \frac{g}{l}\theta = mg$

c) $\frac{d^2\theta}{dt^2} + \frac{g}{l}\theta = 0$

d) $\frac{d^2\theta}{dt^2} - \frac{mg}{l}\theta = 0$

e) $\frac{d^2\theta}{dt^2} - \frac{l}{g}\theta = 0$

10 - Considere o problema em que uma esfera é suspensa por uma mola e executa movimento harmônico simples na direção vertical (Figura abaixo). Toda vez que a mola atinge comprimento máximo, a esfera toca suavemente a superfície de um líquido em um recipiente, gerando uma onda que tem 6 cm de distância entre suas cristas na região próxima ao ponto de contato. Se a velocidade de propagação da onda vale 24 cm/s, a máxima frequência de oscilação da esfera será:



- a) 4 Hz
- b) 2 Hz
- c) 8 Hz
- d) 1 Hz
- e) 16 Hz

Geologia

11 - O que é que permite a deslocação das placas tectônicas?

- a) A existência de um núcleo externo líquido.
- b) A existência da astenosfera, parcialmente fundida.
- c) A existência de terremotos.
- d) A existência de placas rígidas de litosfera
- e) Nenhuma das respostas anteriores

12 - Assinale a sentença correta:

- a) Um aumento na pressão litostática causa um aumento no volume das rochas e um aumento na densidade
- b) Um aumento na pressão litostática causa um aumento no volume das rochas e uma redução na densidade
- c) Um aumento na pressão litostática causa uma redução no volume das rochas e um aumento na densidade
- d) Um aumento na pressão litostática causa uma redução no volume das rochas e uma redução na densidade
- e) Nenhuma das respostas anteriores

13 - O gabro e o granito são exemplos de rochas:

- a) magmáticas vulcânicas

- b) magmáticas extrusivas
- c) magmáticas plutônicas
- d) metamórficas
- e) sedimentares detríticas

14 - As dobras se formam quando as rochas são submetidas a um esforço e apresentam um comportamento.

- a) Rúptil
- b) Elástico
- c) Dúctil
- d) Frágil
- e) Todas as respostas acima

15 - Quais os principais mecanismos de transferência de sedimentos para o talude continental?

- a) Navegação de cabotagem
- b) Correntes de turbidez, canyons submarino e transporte eólico
- c) Ondas e marés
- d) Canyons submarinos
- e) Transporte eólico

Inglês

The radiant energy from the Sun, in conjunction with gravitational energy, determines almost all natural processes that occur at or above the Earth's surface. The hot incandescent Sun emits radiation in a very wide range of wavelengths. The radiation incident on the Earth is largely reflected into space, part enters the atmosphere and is reflected by the clouds or is absorbed and re-radiated into space. A very small part reaches the surface, where it is also partly reflected, especially from the water surfaces that cover three-quarters of the globe. Some is absorbed (e.g., by vegetation) and serves as the source of power for various natural cycles. A small fraction is used to heat up the Earth's surface, but it only penetrates a short distance, some tens of centimeters in the case of the daily cycle and a few tens of meters for the annual changes. As a result, solar energy has negligible influence on internal terrestrial processes. Systems as diverse as the generation of the geomagnetic field and the motion of global lithospheric plates are ultimately powered by the Earth's internal heat.

The Earth is constantly losing heat from its interior. Although diminutive compared to solar energy, the loss of internal heat is many times larger than the energy lost by other means, such as the change in Earth's rotation and the energy released in earthquakes. The energies of tidal deceleration and earthquakes are small fractions of the geothermal flux, which is the most important form of energy originating in the body of the Earth.

The Earth's internal heat derives from several sources. For the past 4 billion years or so the Earth's heat has been obtained from two main sources. One is the cooling of the Earth since its early history, when internal temperatures were much higher than they now are. The other is the heat produced by the decay of long-lived radioactive

isotopes. This is the main source of the Earth's internal heat, which, in turn, powers all geodynamic processes.

Adapted from "Fundamentals of Geophysics", Second Edition, by William Lowrie.

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In each of the questions below, mark the true sentence according to the text.

16-

- a) The Sun emits radiation in every possible wavelength.
- b) The radiation from the Sun is entirely responsible for every process at the Earth's surface.
- c) A small part of the radiation that reaches the Earth is reflected back into space.
- d) The sun's radiation interacts very little with the clouds in the Earth's atmosphere.
- e) The amount of radiation from the Sun that reaches the Earth's surface is a fraction of the total.

17 -

- a) Water is the main component of the Earth's atmosphere.
- b) The waters on the surface of the Earth have no part in the absorption of radiation from the Sun.
- c) On most of the surface of the Earth, water reflects part of the Sun's radiation.
- d) The vegetation absorbs water as a source of power.
- e) The natural cycles of the Earth are regulated by its vegetation.

18 -

- a) The influence of the Sun's radiation below the Earth's surface can reach tens of meters.
- b) Heat from the Sun's radiation is the source of the internal terrestrial processes.
- c) The yearly cycles of the Earth are changing daily.
- d) The internal heat of the Earth is generated by the geomagnetic field.
- e) On the Earth, the motions of tectonic plates are diverse.

19 -

- a) Heat in the interior of the Earth is constant.
- b) The Earth loses internal heat at the same rate as it absorbs heat from the Sun.
- c) The rotation of the Earth releases energy by earthquakes.
- d) The energy of the geothermal flux is the sum of the energy of tidal deceleration and earthquakes.
- e) The geothermal flux is generated within the Earth.

20 -

- a) Multiple causes generate the internal heat of the Earth.
- b) The internal temperature of the Earth has increased since its early history.
- c) Radioactive isotopes are produced by heat from the Earth.
- d) The biggest contribution to Earth's cooling comes from the decay of radioactive isotopes.
- e) The geodynamic processes in the Earth are powerful resources.

GABARITO

1	E	6	E	11	B	16	E
2	B	7	C	12	C	17	C
3	B	8	A	13	C	18	A
4	D	9	C	14	C	19	E
5	B	10	A	15	B	20	A