

آموزشگاه علمی میرابی

MEC

Mirabi Educational Center

جزوه ریاضی آزمون IMAT

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شهریور 1400

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مقدمه مولف:

این جزوه در شهریور ۱۴۰۰ تکمیل شده است و شامل سرفصلهای ریاضی آزمون آیتمت است.

تدریس همه سرفصلهای ریاضی مورد نیاز برای این آزمون، نیاز به هزاران صفحه جزوه دارد که البته در کتب درسی و کمک آموزشی موجود است و هدف ما هم تدریس همه مباحث بصورت جامع نبوده است.

قصد ما از این مجموعه سوالات یک سری سوالات تمرینی و البته با هدف تشخیص نقاط ضعف داوطلب است که وقتی داوطلب این سوالات را خودش حل کند و در مبحثی احساس ضعف کند، میتواند به کتب رفرنس و یا معلم خصوصی مراجعه کرده و ایرادش را رفع کند. اگرچه پاسخ تشریحی همه سوالات آورده شده و سعی شده که این مجموعه سوالات تا حد امکان حالت خودآموز داشته باشد.

از آنجایی که هیچ کاری بی ایراد نیست از خواننده درخواست میشود ایرادات و اشکالات احتمالی این جزوه را از طریق ایمیل mirabieducenter@gmail.com با ما در میان بگذارد.

عماد میرابی

شهریور ۱۴۰۰



Trigonometry

① $\cos \frac{\pi}{5} + \cos \frac{2\pi}{5} + \cos \frac{3\pi}{5} + \cos \frac{4\pi}{5} = ?$

1 $2 \sin \frac{\pi}{5}$ $\sin \frac{\pi}{10}$ 2 0

② $\cos 165 \cdot \cos 105 = ?$

$\frac{-1}{2}$ $\frac{-1}{4}$ $\frac{1}{4}$ $\frac{1}{2}$ None of them

③ $\cos \frac{7\pi}{12} = ?$

$\frac{\sqrt{2} - \sqrt{6}}{4}$ $\frac{\sqrt{2} + \sqrt{6}}{2}$ $\sqrt{2} + 1$ $\sqrt{2} - 1$ $\frac{\sqrt{2} + \sqrt{6}}{4}$

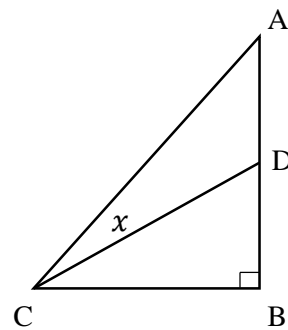
④ In the given figure,

$AD = 2$

$DB = 3$

$BC = 4$

$\tan x = ?$



$\frac{15}{31}$ $\frac{12}{31}$ $\frac{10}{31}$ $\frac{8}{31}$ $\frac{31}{8}$

⑤ $\sin x - \cos x = \frac{5}{13}$, $\sin 2x = ?$

$$\frac{25}{169}$$

$$\frac{108}{169}$$

$$\frac{164}{169}$$

$$\frac{144}{169}$$

$$\frac{145}{169}$$

⑥ Which inequality is correct for all values of x ?

A) $\sin x + \cos x > 1$

C) $\sin x + \cos x < 1$

E) none of them

B) $\sin x + \cos x > \sqrt{2}$

D) $\sin x + \cos x \leq \sqrt{2}$

⑦ How many solutions does this equation have in the interval $(0, \pi)$

$$2\cos^2 x = 4 - 5 \sin x$$

0

1

2

3

4

⑧ What's the general solution for the equation $\sqrt{\sin x} = \sqrt{\cos x}$

$$2K\pi + \frac{\pi}{4}$$

$$2K\pi - \frac{\pi}{2}$$

$$2K\pi$$

$$K\pi + \frac{\pi}{2}$$

$$\frac{K\pi}{2} + \frac{\pi}{4}$$

⑨ $\tan 61 - \tan 16 - \tan 61 \cdot \tan 16 = ?$

0

1

-1

$\frac{1}{2}$

$-\frac{1}{2}$

⑩ $\cos 36 \cdot \cos 72 = ?$

1

$\frac{1}{2}$

$\frac{1}{4}$

$\frac{1}{8}$

$\frac{1}{6}$

Solution of Trigonometry

① $\cos \frac{\pi}{5} = -\cos \frac{4\pi}{5}$ since $\cos \alpha = -\cos(\pi - \alpha)$

Choice E is correct.

② $\cos \alpha \cdot \cos \beta = \frac{1}{2} [\cos(\alpha + \beta) + \cos(\alpha - \beta)]$

$$= \frac{1}{2} [\cos 270 + \cos 60]$$

$$= \frac{1}{2} \left(0 + \frac{1}{2} \right) = \frac{1}{4}$$

- ③ Solution No. 1: $\sin \frac{7\pi}{12}$ is in the 2nd quarter, the result is negative.

Choice A is correct.

$$\text{Solution No. 2: } \cos \left(\frac{\pi}{4} + \frac{\pi}{3} \right) = \frac{\sqrt{2}}{2} \times \frac{1}{2} - \frac{\sqrt{2}}{2} \times \frac{\sqrt{3}}{2} = \frac{\sqrt{2}-\sqrt{6}}{4}$$

④ $\left. \begin{array}{l} \angle ACB = \alpha \\ \angle DCB = \beta \end{array} \right\} \Rightarrow \tan x = \tan(\alpha - \beta) = \frac{\tan \alpha - \tan \beta}{1 + \tan \alpha \cdot \tan \beta} = \frac{\frac{5}{4} - \frac{3}{4}}{1 + \frac{5}{4} \times \frac{3}{4}} = \frac{\frac{1}{2}}{1 + \frac{15}{16}} = \frac{8}{31}$

⑤ $(\sin x - \cos x)^2 = \frac{25}{169}$

$$1 - 2 \sin x \cos x = \frac{25}{169} \Rightarrow \sin 2x = \frac{144}{169}$$

- ⑥ Choice D is correct.

$$\sin x + \cos x = \sqrt{2} \sin \left(x + \frac{\pi}{4} \right) \leq \sqrt{2}$$

⑦ $2(1 - \sin^2 x) = 4 - 5 \sin x$

$$2\sin^2 x - 5 \sin x + 2 = 0$$

$$\Delta = 25 - 16 = 9 \Rightarrow \sin x = \frac{5 \pm 3}{4} = 2 \text{ or } \frac{1}{2}$$

$$\sin x = \frac{1}{2} \Rightarrow x = \frac{\pi}{6}, \frac{5\pi}{6}, \text{ 2 solutions, choice C is correct.}$$

⑧ $\sin x = \cos x = \frac{\sqrt{2}}{2} \Rightarrow x = 2K\pi + \frac{\pi}{4}$

x must be in the 1st quarter, so that both sine and cosine be positive.

Choice A is correct.

⑨ $61 - 16 = 45^\circ$

$$\tan(61 - 16) = 1 \Rightarrow \frac{\tan 61 - \tan 16}{1 + \tan 61 \cdot \tan 16} = 1 \Rightarrow \tan 61 - \tan 16 = 1 + \tan 61 \cdot \tan 16$$

Choice B is correct.

⑩ $\frac{2 \sin 36 \cdot \cos 36 \cdot \cos 72}{2 \sin 36} = \frac{\sin 72 \cdot \cos 72}{2 \sin 36} = \frac{\sin 144}{4 \sin 36} = \frac{1}{4}$

Choice C is correct.

Coordinate Geometry

① Three points $A(3, 2)$, $B(m + 1, m)$, $C(m^2, m + 1)$ are collinear.

What's the y -intercept of the line?

- A) -4 B) -1 C) 5 D) 1 E) 0

② What's the distance of intersection of lines $y = 3x + 5$, $2x + y = -10$ to the origin?

- A) 25 B) 5 C) $\sqrt{5}$ D) $2\sqrt{5}$ E) $3\sqrt{5}$

③ Point $A(\alpha, 2\alpha)$ is the center of a circle passing through $(2, 1)$, $(-1, 4)$.

What's the radius of this circle

- A) 3 B) 4 C) $2\sqrt{2}$ D) $3\sqrt{2}$ E) 5

④ Two sides of a square lie on $2x - 2y = 3$, $y = x + 1$. What's the area of the square?

- A) $\frac{9}{8}$ B) $\frac{9}{4}$ C) $\frac{25}{8}$ D) $\frac{25}{4}$ E) $\frac{4}{9}$

⑤ $A(7, 6)$ is a vertex of a parallelogram. If two sides of this parallelogram lie on the lines $2y - 3x = 11$, $3y + 4x = 8$, what's the coordinate of midpoint of its diagonals