MATHEMATICS

Instruction: *You are offered the test tasks with one correct answer from five proposed. The selected answer should be marked on the answer sheet by painting the appropriate circle.*

1. Which of the following statements is true for the sum of prime numbers between 20 and 30?

A) multiple of 13
B) is a prime number
C) multiple of 17
D) divisible by 14
E) factor of 154

2. Find the equation whose roots are $2+\sqrt{5}$ and $2-\sqrt{5}$.

A) $x^2-4x+1=0$
B) $x^2-4x-5=0$
C) $x^2-5x-4=0$
D) $4x^2-x-1=0$
E) $x^2-4x-1=0$

3. Solve the system of equations: $\begin{cases}\lg(x-y)=3\\ \lg x=\lg 5+\lg y\end{cases}$

A) $(800;40)$
B) $(1200;50)$
C) $(1350;170)$
D) $(1150;150)$
E) $(1250;250)$

4. How many liters of acid should be added to 60 L of a 25% acid solution in order to produce a 40% acid solution?

A) 35 L
B) 20 L
C) 25 L
D) 15 L
E) 10 L

5. Solve the inequality: $4^{\log_2(x^2-3x+2)}\le 4$

A) $(0;1)$
B) $(1;2)$
C) $[0;1)\cup(2;3]$
D) $(3;+\infty)$
E) $(2;3]$

6. Solve the system of inequalities: $\begin{cases} \sqrt{x^4-2x^2+1} > 1-x \\ \sqrt{x^2-25}\cdot\sqrt{25-x^2} \geq 0 \end{cases}$

A) ± 5
B) $[-5;-2)\cup(0;1)\cup(1;5]$
C) $(0;1)\cup(1;5]$
D) $(-\infty;-5]\cup[5;+\infty)$
E) $[-5;5]$

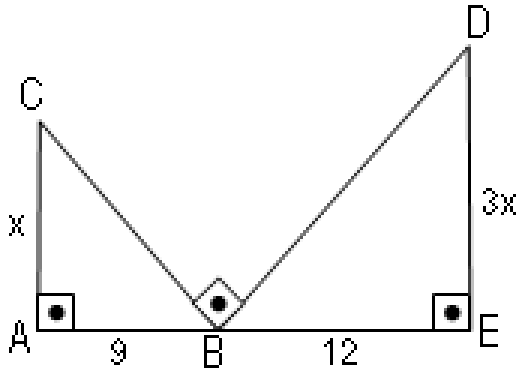
7. Three numbers form an arithmetic sequence. If we add 8 to the first number, we get a geometric sequence with the sum of terms equal to 26. Find these three numbers.

A) –6; 6; 18 or 10; 6; 2
B) 0; 6; 12 or 9; 6; 3
C) –2; 8; 18 or 12; 8; 4
D) –4; 6; 16 or 10; 6; 4
E) –4; 8; 18 or 12; 8; 2

8. Find the extrema of the function $f(x)=4x+x^2$

A) –2
B) 4
C) 0
D) –4
E) 2

9. Find the length of DE.



A) 18
B) 16
C) 20
D) 21
E) 12

10. $\overrightarrow{OA}=(-2;1;3)$, $\overrightarrow{OB}=(2;3;-1)$ and $\overrightarrow{AB}=2\overrightarrow{BC}$ are given. Find $\overrightarrow{OC}$.

A) $(2;2;-2)$

B) $(2;4;-2)$

C) $(0;2;-3)$

D) $(4;4;-3)$

E) $(0;-2;-1)$

11. In an arithmetic sequence, the first term is –2 and the common difference is 3. Which term of this sequence is 34?

A) 12

B) 11

C) 14

D) 16

E) 13

12. Simplify the expression: $\left(-\frac{9m^{3.5}}{8n^{0.5}}\right)^3 \cdot \left(\frac{4n^{\frac{3}{8}}}{3m^{2.5}}\right)^4$

A) $-2.7\sqrt{m}$

B) $\frac{m^2}{n}$

C) $-1.5\sqrt{mn}$

D) $2.5\sqrt{n}$

E) $-4.5\sqrt{m}$

13. Solve the system of inequalities: $\begin{cases}\sqrt{x+2}-\sqrt{2x+1}\le 0\\ \sqrt[5]{x-2}>1\end{cases}$

A) $(3;+\infty)$

B) 3

C) $[-2;+\infty)$

D) $(-2;3)$

E) $[3;+\infty)$

14. Evaluate the following integral: $\int_0^{\frac{\pi}{3}} \sin 2x dx$

A) $\frac{3}{8}$

B) $\frac{8}{3}$

C) $\frac{4}{3}$

D) $\frac{3}{4}$

E) $\frac{1}{2}$

15. Find general equation of a circle with center $M(-1;2)$ and radius 4 cm.

A) $(x+1)^2-(y-2)^2=16$

B) $(x+1)^2+(y-2)^2=4$

C) $(x-2)^2+(y+1)^2=16$

D) $(x+1)^2+(y-2)^2=16$

E) $(x-1)^2+(y+2)^2=16$

16. Find the value of the expression: $10\cdot 0{,}0081^{\frac{1}{4}}-\left(-\frac{1}{5}\right)^{-2}+4\cdot 16^{-\frac{1}{2}}$

A) 10

B) 0

C) 1

D) 4

E) -21

17. If $|\vec{a}|=|\vec{b}|=1$ and $\vec{a}\cdot\vec{b}=0.5,$ find the angle between vectors of $\vec{a}$ and $\vec{b}$.

A) $90°$

B) $30°$

C) $45°$

D) $120°$

E) $60°$

18. Erik can plough a garden in 20 hours and Kasym can do the same job in 32 hours. They work together for eight hours, then Kasym stops working. How long will it take Erik to finish the job alone?

A) 7 h
B) 9 h
C) 6 h
D) 10 h
E) 8 h

19. Solve the system of inequalities: $\begin{cases} \sqrt[3]{8x+3} > 3 \\ \sqrt{2x+3} \le 5 \end{cases}$

A) $(2;12]$
B) $(4;11]$
C) $(3;12)$
D) $(3;11]$
E) $(0;3)$

20. Find the dot product of the vectors $\vec{a} = (1;-2;5)$ and $\vec{b} = (-2;3;4)$.

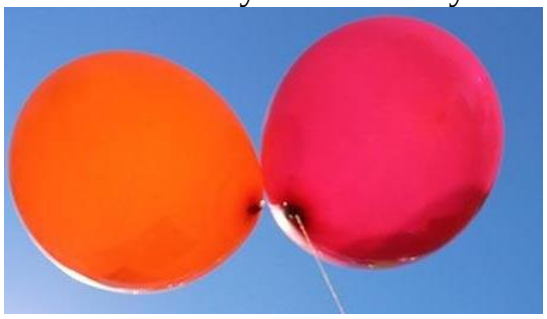
A) 18
B) 15
C) 12
D) 28
E) 20

Instruction: *You are offered the test items on the base of context with one correct answer from five proposed ones. Read the context attentively and do the items. The selected answer should be marked on the answer sheet by full painting the appropriate circle.*

World of balls

There are 36 balls in the box. These are 5-yellow, 4-red, 7-green, 8-blue, 6-orange and 6-purple.

21. In how many different ways we can make pairs from 36 balls?



A) 36!
B) 1260
C) 18
D) 630
E) 16!

22. We take one ball from the box. What is the probability that chosen ball is orange?

A) 1

B) $\frac{1}{6}$

C) $\frac{1}{9}$

D) $\frac{7}{36}$

E) $\frac{2}{9}$

23. How many times we can put balls in *blue, yellow, purple, red, green and orange* order?

A) 6

B) 10

C) 3

D) 5

E) 4

24. At least how many balls we must take that two of them are the same colour?

A) 2

B) 7

C) 6

D) 27

E) 36

25. We take three balls from the box. What is the probability that chosen balls are 1-yellow,1-red and 1-blue?

A) $\frac{8}{357}$

B) $\frac{4}{119}$

C) $\frac{1}{2}$

D) $\frac{16}{357}$

E) $\frac{1}{3}$

Instruction: *You are offered the test tasks with one or more correct answers from multiple choices. The selected answer should be marked on the answer sheet by painting the appropriate circle.*

In the test tasks with one or more correct answers there can be up to three correct answers.

26. Simplify the expression: $\dfrac{\sqrt[3]{2^{12}}\cdot\sqrt[5]{243}}{36^{\frac{1}{2}}}$

A) 24
B) 12
C) 2^3
D) 8
E) 6
F) 2^4
G) 16
H) 48

27. Of the following find multiples of the root of the equation: $4\log_{81}(5x-12)=1$

A) 15; 25; 75
B) 36; 52; 216
C) 5; 15; 25
D) 21; 24; 27
E) 16; 36; 54
F) 36; 54; 216
G) 12; 15; 18
H) 4; 12; 16

28. Solve the system of equations: $\begin{cases} 5^{2+\log_5(x-y)}=100 \\ \lg(x+y)+\lg(x-y)=1+\lg 4 \end{cases}$. Find $x+y$.

A) 11
B) 10
C) 12
D) 7
E) 6
F) 13
G) 9
H) 8

29. Dilda can do every work three times as fast as Ulzhan. Working alone, Ulzhan can do a job in 36 days. How long would it take Dilda to do one-third of the job alone?
A) 120 hours
B) 96 hours
C) 6 days
D) 144 hours
E) 4 days
F) 7 days
G) 168 hours
H) 5 days

30. Of the following, choose the value(s) that is/are in the interval

$$\log_2 \frac{x-2}{x+2} - \log_2 0.25 < 0$$

A) $3\frac{1}{3}$
B) 2
C) $2\frac{1}{3}$
D) 3.4
E) 4
F) 3
G) $2\frac{1}{2}$
H) $3\frac{2}{3}$

31. Solve the system of equations: $\begin{cases} 5^{\log_5(x-y)} = 5 \\ \log_3(x+y) = 2 \end{cases}$. Find $x \cdot y$.

A) 11
B) 10
C) 13
D) 15
E) 9
F) 16
G) 12
H) 14

32. Find the volume of the solid formed by rotating the figure bounded by graphs of $y = x^3, x = 1, x = 2, y = 0,$ around x-axis.

A) $\frac{127}{7}\pi$

B) $\frac{15\pi}{3}$

C) $\frac{\pi}{6}$

D) $30°$

E) $45°$

F) $\frac{\pi}{4}$

G) $18\frac{1}{7}\pi$

H) 5π

33. What is the angle between $\vec{a} = (1; \sqrt{3})$ and $\vec{b} = (-4; -4\sqrt{3})$

A) $\frac{\pi}{2}$

B) $30°$

C) $90°$

D) $\frac{\pi}{3}$

E) π

F) $180°$

G) $60°$

H) $\frac{\pi}{6}$

34. Evaluate definite integral: $\int_{-3}^{-2} \frac{x^3 - x^2 - x + 1}{x^2 - 1} dx$

A) $-\frac{7}{2}$

B) $\frac{5}{2}$

C) 2.5

D) 1.5

E) $\frac{3}{2}$

F) $-\frac{9}{2}$

G) -4.5

H) -3.5

35. $\vec{u} + \vec{v} = (3;6)$, $\left|\vec{u}\right|^2 + \left|\vec{v}\right|^2 = 23$. Find $\vec{u} \cdot \vec{v}$.

A) 15

B) $\sqrt{8}$

C) $5\sqrt{2}$

D) $2\sqrt{2}$

E) 11

F) $\sqrt{50}$

G) $3\sqrt{3}$

H) $\sqrt{27}$

MATHEMATICS TEST IS COMPLETED