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EXAM 5

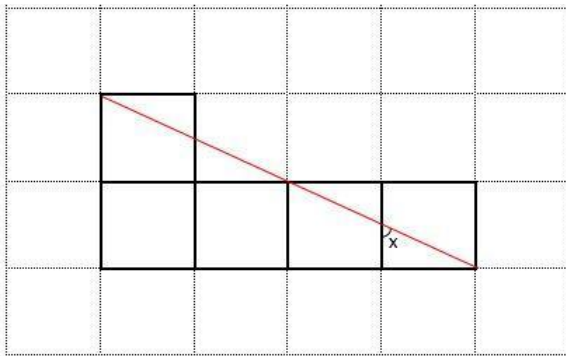
1. In an airplane, the passengers are asked which languages they can speak. 41 passengers can speak Russian, 67 can speak English, 72 can speak Chinese, 15 can speak English and Russian, 12 can speak Russian and Chinese, 35 can speak English and Chinese, and 5 can speak English, Russian and Chinese. Find the number of passengers.

- A) 127 B) 123 C) 172 D) 140

2. Let $n(A-B)=15$, $n(B-A)=13$ and $n(A\cup B)=45$. Find $n(A\cap B)$.

- A) 17 B) 28 C) 32 D) 30

3. All the squares in the figure are congruent and have side 1 unit. Find the $\sin x$.



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

4. Calculate. 5^{a+2} if $25^a=3$.

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

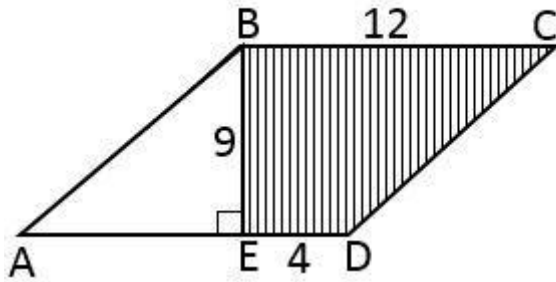
5. Calculate.

$$\frac{4 - \frac{2 + \frac{2}{3}}{3}}{\frac{2}{3} - 1} - 1 = ?$$

$$3 + \frac{2 - \frac{2}{3}}{4}$$

- A) $-\frac{1}{5}$ B) $\frac{4}{5}$ C) $1\frac{4}{5}$ D) $-\frac{4}{5}$

6. ABCD is a parallelogram. Find the area of shaded region.



- A) 48 B) 18 C) 54 D) 72

7. If $60^a = 3$ and $60^b = 5$ then calculate $12^{\frac{1-a-b}{1-b}}$.

[use logarithm to evaluate]

- A) 144 B) 4 C) 225 D) 15

8. Calculate. $\sqrt[3]{9+\sqrt{80}} + \sqrt[3]{9-\sqrt{80}}$.

- A) 3 B) 9 C) 1 D) $\sqrt[3]{9}$

9. Simplify.

$$\frac{\left(5^{\frac{1}{2}}-1\right)}{\left(5^{\frac{1}{8}}+1\right)\left(5^{\frac{1}{8}}-1\right)}$$

- A) $5^{\frac{1}{2}}-1$ B) $5^{\frac{1}{4}}-1$ C) $5^{\frac{1}{2}}+1$ D) $5^{\frac{1}{4}}+1$

10. If $\left. \begin{array}{l} a+b-c=2 \\ a^2+b^2+c^2=6 \end{array} \right\}$, then calculate the value of $ac+bc-ab$.

- A) 3 B) 8 C) 4 D) 1

11.

If $\frac{1}{x^2} + 16x^2 = 32$ for a positive real number x , then calculate the value of $4x + \frac{1}{x}$.

- A) $\sqrt{40}$ B) 24 C) 16 D) 48

12. If $\left. \begin{array}{l} a - b = 21 \\ \sqrt{a} - \sqrt{b} = 3 \end{array} \right\}$, then calculate the value of $a + b$.

- A) 33 B) 28 C) 27 D) 29

13.

The equation of a circle in the xy -plane $x^2 + y^2 + 6x - 2y = -1$ is given. Find the radius of the circle.

- A) 2 B) 3 C) 4 D) 9

14. Given that $\frac{1}{a} + \frac{1}{b} = 2$ and $3^a = 5^b = x$. Find the value of x .

[use logarithms to evaluate]

- A) $x = 225$ B) $x = 15$ C) $x = \sqrt{15}$ D) $x = \sqrt[3]{15}$

15. A $3 \times 4 \times 5$ solid block is made up of $1 \times 1 \times 1$ unit cubes. The outside surface of the block is painted black. How many unit cubes have exactly one face painted black?

- A) 16 B) 18 C) 20 D) 22

16.

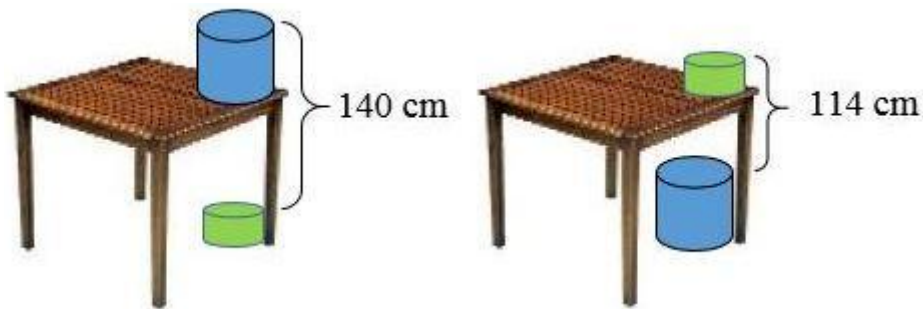
If $f(x) = 4 + 2x^2$, find the integer value of k for which $(2k) = 18k$.

- A) -2 B) 0 C) 1 D) 2

17. Solve the equation $7 \times 3^{x+1} - 5^{x+2} = 3^{x+4} - 5^{x+3}$.

- A) - 2 B) - 1 C) 0 D) 1

18. Find the height of the table.



- A) 54 cm B) 81 cm C) 127 cm D) 254 cm

19. If $x + 2$ is a factor of $x^4 + x^3 + 3x^2 + kx - 10$, then find k .

- A) - 5 B) - 13 C) 15 E) 5

20. Simplify. $\frac{[(n+1)!]^3}{(n!)^3}$

- A) n B) $n + 1$ C) n^3 D) $(n + 1)^3$

21. A right circular cone has a base radius of r and a height of h . If the radius is decreased by 20 percent and the height is increased by 10 percent, which of the following is the resulting percent change in the volume of the cone?

- A) 10% decrease B) 12% decrease
 C) 18.4% decrease D) 29.6% decrease

22.

In the xy -plane, the line $y = 2x + b$ intersects the parabola $y = x^2 + bx + 5$ at the point $(3, k)$. If b is a constant, what is the value of k ?

- A) 0 B) 1 C) 2 D) 3

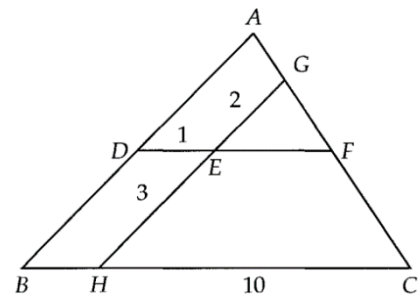
23. If $|4x - 4| = 8$ and $|5y + 10| = 15$, what is the smallest possible value of xy ?

- A) - 1 B) - 3 C) - 5 D) - 15

24. In the figure below, \overline{AB} is parallel to \overline{GH} and \overline{DF} is parallel to \overline{BC} .

If $|DE| = 1$, $|EH| = 3$, $|EG| = 2$, and $|HC| = 10$, what is the length of $|AD|$?

- A) 2.5 B) 3 C) 3.5 D) 4

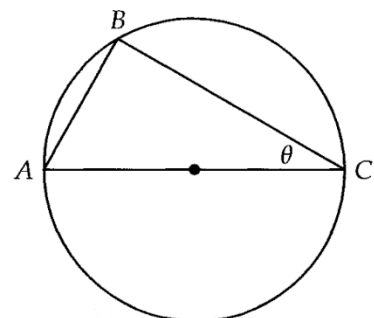


Note: Figure not drawn to scale.

25.

In the figure below, AC is a diameter of the circle. If $AC = 1$, which of the following gives the area of triangle ABC in terms of θ ?

- A) $\frac{\theta}{2}$
 B) $\frac{\tan\theta}{2}$



C) $2\sin\theta$

D) $\frac{\sin\theta\cos\theta + \cos\theta\sin\theta}{2}$

26.

The table below summarizes the distribution of living situations for residences in a neighborhood. If a duplex in the neighborhood is to be inspected at random, what is the probability that the residence is occupied by no more than 2 family members?

Family members	Type of Residence			Total
	Apartment	Duplex	Single residence	
1	10	22	3	35
2	20	12	13	45
3	8	8	12	28
4 or more	8	4	18	30
Total	46	46	46	138

A) $\frac{6}{23}$

B) $\frac{17}{23}$

C) $\frac{15}{23}$

D) $\frac{11}{23}$

27. Evaluate $75 \times 4 + 1$.

A) 12

B) 4

C) 16

D) 2

28. Find the increasing interval of function $f(x) = \sqrt{x^2 - 1}$.

A) $(-\infty; -1) \cup (1; +\infty)$

B) $(-\infty; -1] \cup [1; +\infty)$

C) $[1; +\infty)$

D) $(-\infty; -1]$

29. Find the area of the figure bounded by $y = x^3$, $x = y^2$.

A) 1

B) $\frac{5}{12}$

C) $\frac{1}{4}$

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

30. Solve $\int \frac{\cos^2 x}{1 - \sin x} dx$

A) $x + \cos x + C$

B) $x + \sin x + C$

C) $x - \cos x + C$

D) $1 - \sin x + C$

31.

$A(2, -1, -3)$, $B(-3, 5, 2)$, $C(-2, 3, -5)$ are the vertices of triangle ABC . If BM is a median of triangle ABC , then find the length of BM .

A) $\sqrt{57}$

B) $\sqrt{55}$

C) 9

D) $\sqrt{61}$

32.

Given the arithmetic sequence 15, 20, 25, Determine which term of arithmetic sequence is equal to 265.

A) 49th

B) 57th

C) 51st

D) 55th

33. Given that $f(x - 1) = 3x + 4$, find the $f(2x + 1)$.

A) $6x + 10$

B) $3x + 10$

C) $6x + 9$

D) $6x^2 + 11x + 4$

34. Evaluate the sum of the first six terms of the geometric sequence 2, 1, $\frac{1}{2}$, ...

A) $\frac{73}{22}$

B) $\frac{31}{8}$

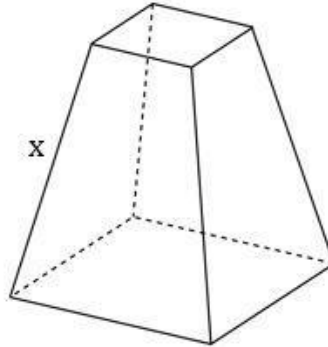
C) $\frac{63}{16}$

D) $\frac{57}{16}$

35.

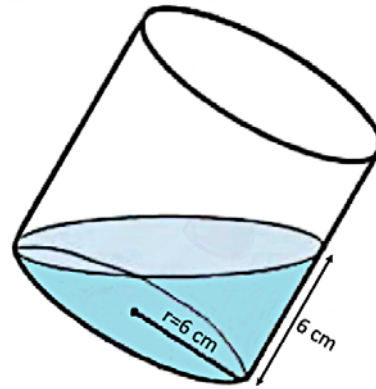
The sides of the bottom and top bases of the regular frustum square pyramid are 6 cm and 4 cm , respectively, and height $\sqrt{23}\text{ cm}$. Find the length of the lateral edge x of the frustum pyramid.

- A) 1.5 cm
- B) 4 cm
- C) 3 cm
- D) 5 cm



36. Find the volume of the water.

- A) $108\pi\text{ cm}^3$
- B) $144\pi\text{ cm}^3$
- C) $72\pi\text{ cm}^3$
- D) $84\pi\text{ cm}^3$



37. If $a+2b=1$ and $2a-b=2$, then calculate $\frac{2a^2+3ab-2b^2}{\frac{a}{2}+b}$.

- A) $1\frac{1}{2}$
- B) $2\frac{1}{2}$
- C) $3\frac{1}{2}$
- D) 4

38. Find m . OR

$$\begin{array}{r} x^6 - x^4 + x^2 + m \\ \hline \end{array} \Bigg| \begin{array}{r} x^2 - 1 \\ \hline B(x) \end{array}$$

OR

$$\begin{array}{r} x^6 - x^4 + x^2 + m \\ \hline \end{array} \Bigg| \begin{array}{r} x^2 - 1 \\ \hline B(x) \end{array}$$

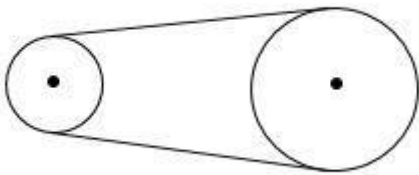
- A) -2 B) -1 C) 0 D) 1

39. A rectangular box with a square base and an open top is to be constructed using 48 square meters of material. Find the maximum volume of the box in cubic meters.

- A) 2 B) 4 C) 16 D) 32

40.

A belt snugly fit around the two wheels with radii $2-\sqrt{3}$ units and $5-\sqrt{3}$ units as in the figure. Their centers are 6 units apart. If π is taken as 3, what is the length of the belt?



- A) 20 units B) 22 units C) 24 units D) 26 units