



akfa
UNIVERSITY

AKFA University Admissions 2021 Mathematics Exam

Please do not open the examination paper until directed to do so.

READ INSTRUCTIONS FIRST:

- ONLY the Answer Sheet is graded. This exam booklet is NOT to be graded.
 - Calculators are NOT allowed.
 - Read the additional instructions in the beginning of the sections.
 - Use of any electronic device (Phone, iPod, iPad, laptop) is NOT allowed during the examination.
 - Cheating, talking to fellow students, singing, turning back are not allowed!
 - If you have a problem please raise your hand and wait quietly for a Proctor.
 - You are NOT allowed to leave the exam room until you submit the exam papers.
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EXAM STRUCTURE:

- There are 3 sections and 20 questions in total. Negative marking is applied.
 - Section 1: 10 easy questions. Each correct answer worth 4 points. -1 point for every incorrect answer.
 - Section 2: 5 medium level questions. Each correct answer worth 5 points. -1.25 point for every incorrect answer.
 - Section 3: 5 difficult questions. Each correct answer worth 7 points. -1.75 point for every incorrect answer.
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1. (4 points) How many numbers greater than 1000 can be formed with the digits 3,4,6,8 if a digit cannot occur more than once in a number?

A. 12 B. 48 C. 4 D. 24

2. (4 points) Given the function $f(x) = e^{kx} + x$ and $f'(0) = -8$. Find the value of k .

A. -9 B. -8 C. 8 D. 0

3. (4 points) Find the sum $x + y$ of the solution x, y for the following system of equations

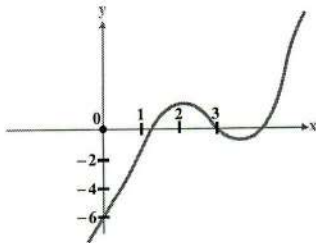
$$\begin{cases} \frac{1}{3}x - \frac{1}{6}y = 7, \\ \frac{1}{5}y - \frac{1}{5}x = 8 \end{cases}$$

A. -93 B. 55 C. 204 D. 81.6

4. (4 points) In an airport security line, every 20th person has his bag searched, and every 10th person is asked to put her shoes through a special X-ray machine. Of 100 passengers, what is the probability that a passenger will be asked to put his shoes through the X-ray and have his bag searched?

A. $\frac{1}{100}$ B. $\frac{1}{50}$ C. $\frac{1}{20}$ D. $\frac{1}{10}$

5. (4 points) The graph of $y = f(x)$ is shown below. if $f(3) = a$, which of the following could be the value of $f(a)$?



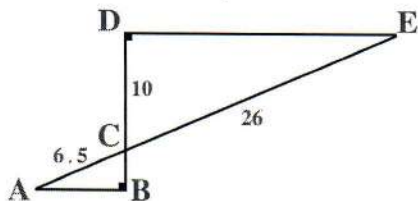
A. -6 B. 0 C. -2 D. -4

Use this space for calculations.

6. (4 points) A cell phone provider charges customers a one time setup fee of 40\$ plus k dollars for each month. If a customer paid \$1120 for the first 12 months, including the setup fee, what is the value of k ?

A. 80 B. 90 C. 100 D. 110

7. (4 points) In the following figure, $\overline{CD} = 10$, $\overline{CE} = 26$, $\overline{AC} = 6.5$. What is the length of \overline{AB} ?



A. 5 B. 5.5 C. 6 D. 6.5

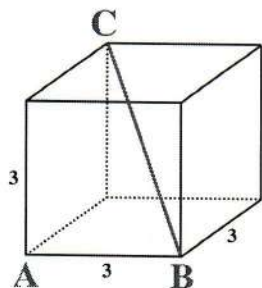
8. (4 points) The expression $\frac{x^2}{5} - 1$ can be written as $\frac{1}{5}(x + a)(x - a)$, where a is a positive real number. What is the value of a ?

A. $\sqrt{5}$ B. 1 C. 5 D. 25

9. (4 points) The growth of a certain kind of bacteria is observed and its population growth, P , t days from the first observation, is modeled by $P(t) = 1000 \times 2^{\frac{t}{3}}$. By how much the population of the bacteria increase from $t = 3$ and $t = 9$?

A. 2000 B. 4000 C. 6000 D. 8000

10. (4 points) A square cube has a side length of 3. What is the length of a diagonal that cuts through the center of the cube?



Note: figure not drawn to scale

A. 3 B. $3\sqrt{2}$ C. $3\sqrt{3}$ D. $3\sqrt{4}$

11. (5 points) Determine the derivative of the following function at $x = \pi/6$

$$f(x) = \ln(\sin(x))$$

A. $\sqrt{3}$ B. 2 C. $-\sqrt{3}$ D. $\frac{1}{\sqrt{3}}$

12. (5 points) Which of the following is equivalent to

$$\frac{3x^2 + 7x - 3}{3x + 1}$$

A. $x + \frac{7}{3}$ B. $x + 2 - \frac{5}{3x+1}$ C. $x + 1 - \frac{5}{3x+1}$
D. $x + \frac{7}{3} - \frac{3}{x}$

13. (5 points) A bowl contains 5 red, 3 blue and 2 green balls. If 2 balls are picked at random, what is the probability that both of them are red?

A. $\frac{1}{2}$ B. $\frac{2}{5}$ C. $\frac{2}{9}$ D. $\frac{3}{5}$

14. (5 points) If $f\left(\frac{3x}{x-4}\right) = x^2 + x + 1$, what is the value of $f(5)$?

A. 111 B. 100 C. 55 D. 18

15. (5 points) Find the maximum rate of change of the function $f(x) = 5 + 6x^2 - x^3$ in the interval $[0,3]$.

A. 12 B. 5 C. 32 D. 37

Use this space for calculations.

16. (7 points) Find the sum of the roots for the following polynomial

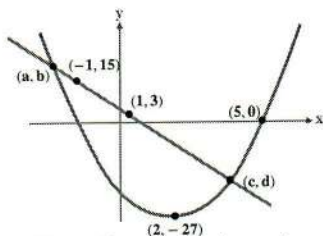
$$(x + 5)(x^2 - x - 6)(x^3 - 13x - 12)$$

A. 0 B. 5 C. -4 D. -2

17. (7 points) Let $g(x)$ be the inverse of $f(x) = \ln(x^3)$. What is the value of $g'(0)$?

A. $\frac{1}{3}$ B. $\frac{1}{2}$ C. 1 D. 2

18. (7 points) A quadratic and linear functions intersect at two points with the coordinates (a, b) and (c, d) . The vertex of the quadratic function is at $(2, -27)$ and it has an x-intercept at $(5, 0)$. The points $(-1, 15)$ and $(1, 3)$ lie on the linear function. What is the value of $b - d$?



Note: figure not drawn to scale

A. 21 B. 57 C. 41 D. 36

19. (7 points) When throwing a die 3 times, find the probability of the product of the three results being a multiple of 9.

A. $\frac{7}{27}$ B. $\frac{1}{9}$ C. $\frac{4}{27}$ D. $\frac{2}{9}$

20. (7 points) Let $f(x) = 3x^2 - x$. Evaluate the following sum

$$\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{6}{n} f\left(\frac{3k}{n}\right).$$

A. 45 B. 36 C. 60 D. 15

