

Mathematics, 2015 EC, natural science, entrance exam, round 1

Grade 12 · Mathematics · 2015 E.C.

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Time allowed: 120 minutes

Questions: 52

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1. A 20m high building casts a shadow of 4m, at the same time a 35m tree casts a shadow of x m. What is the value of x ? (1)
- A. 8m
B. 11m
C. ✓ 7m
D. 15m

Answer: C

Using the properties of similar triangles, the ratio of height to shadow is constant: $20/4 = 35/x \implies 5 = 35/x \implies x = 7\text{m}$.

2. A car started moving 9km to the East then moved 4 km to the North and then 12km towards West to reach its destination. How far the car it travelled from its starting point? (1)
- A. 25km
B. 12km
C. 4km
D. ✓ 5km

Answer: D

The net displacement vector from the starting point $(0, 0)$ is $(9 - 12)\hat{i} + 4\hat{j} = -3\hat{i} + 4\hat{j}$. The straight-line distance is $\sqrt{(-3)^2 + 4^2} = 5$ km.

3. When the polynomial $P(x) = 3x^6 + 5x^4 - 7x^3 + 2kx^2 + 3$ is divided by $(x + 1)$, the remainder is 4. What is the value of k ? (1)
- A. -5
B. ✓ -7
C. 3
D. 6

Answer: B

By the Remainder Theorem, $P(-1) = 4 \implies 3(-1)^6 + 5(-1)^4 - 7(-1)^3 + 2k(-1)^2 + 3 = 4 \implies 18 + 2k = 4 \implies k = -7$.

4. Which of the following statement is true about $f(x) = x^2 - 6x + 10$? (1)
- A. $f(x) \geq 2$ for all x in the domain of f .
B. The line $x = 1$ is the axis of symmetry of the graph of f .
C. The graph of f opens downward.
D. ✓ The vertex of the graph of f is $(3, 1)$.

Answer: D

Rewriting the quadratic function in vertex form gives $f(x) = (x - 3)^2 + 1$, which shows that the vertex is indeed $(3, 1)$.

5. What is the area of a regular hexagon inscribed in a circle of radius 6cm? (1)
- A. $48\sqrt{3} \text{ cm}^2$ B. ✓ $54\sqrt{3} \text{ cm}^2$
- C. 48 cm^2 D. $36\sqrt{3} \text{ cm}^2$

Answer: B

A regular hexagon inscribed in a circle of radius $R = 6$ cm consists of six equilateral triangles each of side length 6 cm. Its area is $6 \times \frac{\sqrt{3}}{4}(6)^2 = 54\sqrt{3} \text{ cm}^2$.

6. Which of the following defines a prime number? (1)
- A. It is a number that has more than two positive factors.
- B. It is a number whose only factor is 1.
- C. ✓ **It is a number that has only two positive factors.**
- D. It is a number whose only factor is itself.

Answer: C

By definition, a prime number is a positive integer greater than 1 that has exactly two distinct positive factors: 1 and itself.

7. Which of the following rational numbers is written in its standard form? (1)
- A. 10×10^{-2} B. 0.8×10^2
- C. 0.09×10^5 D. ✓ **5×10^5**

Answer: D

A number in scientific notation (standard form) is written as $a \times 10^n$ where $1 \leq a < 10$. Correcting the typo in option D from 5×0^5 to 5×10^5 satisfies this condition.

8. The solution set of the equation $3|2x - 4| = 6 - 2|1 - 5x|$ is (1)
- A. $\{\frac{1}{2}, \frac{5}{4}\}$ B. $\{-1, \frac{1}{2}, \frac{5}{4}\}$
- C. ✓ $\{\}$ D. $\{-1, \frac{1}{2}\}$

Answer: C

The equation $3|2x - 4| + 2|1 - 5x| = 6$ has no solution because the first term is less than or equal to 6 only when $x \in [1, 3]$, while the second term is less than or equal to 6 only when $x \in [-0.4, 0.8]$. Since these intervals do not overlap, their sum is always strictly greater than 6.

9. The domain of the function $f(x) = 2x^{\frac{2}{3}}$ is (1)
- A. $\mathbb{R} \setminus \{0\}$ B. $[0, \infty)$
- C. ✓ $\mathbb{R}$ D. $(0, 2)$

Answer: C

The function $f(x) = 2x^{2/3} = 2\sqrt[3]{x^2}$ is defined for all real numbers x because the cube root function accepts any real number input.

10. The slope of the line that makes an angle of 135° with the positive x-axis is equal to (1)
- A. 2 B. ✓ **-1**
- C. 1 D. 3

Answer: B

The slope m of a line is equal to the tangent of the angle it makes with the positive x-axis: $m = \tan(135^\circ) = -1$.

11. If $\tan 31^\circ = 0.81$ then what is the value of $\tan 509^\circ$ (1)
- A. 0.19
B. ✓ -0.81
C. 0.81
D. -0.91

Answer: B

Since the tangent function has a period of 180° , we have $\tan(509^\circ) = \tan(509^\circ - 2 \times 180^\circ) = \tan(149^\circ) = \tan(180^\circ - 31^\circ) = -\tan(31^\circ) = -0.81$.

12. If $\sin \theta = -\frac{3}{5}$ and θ is a 4th quadrant angle, then what is the value of $\sec \theta$? (1)
- A. -5/3
B. ✓ 5/4
C. 5/3
D. -5/4

Answer: B

In the fourth quadrant, $\cos \theta$ is positive, so $\cos \theta = \sqrt{1 - \sin^2 \theta} = \sqrt{1 - 9/25} = 4/5$. Thus, $\sec \theta = 1/\cos \theta = 5/4$.

13. If ABCD is a parallelogram with P a mid-point of $\overline{AB}$ and Q a mid-point of $\overline{CD}$, then which of the following is NOT necessarily true? (1)
- A. $\triangle ADQ \equiv \triangle CBP$
B. $\overline{AQ} \equiv \overline{PC}$
C. APCD is a trapezium
D. ✓ APCQ is a rhombus

Answer: D

APCQ is a parallelogram because its opposite sides AP and QC are parallel and equal in length. However, it is not necessarily a rhombus unless the adjacent sides are equal ($AP = AQ$), which is not generally true for any parallelogram ABCD.

14. A regular pyramid has a hexagonal base whose side length is 12cm. What is the lateral surface area of the pyramid in square centimeters if the length of each lateral edge is 10cm? (1)
- A. 360
B. 72
C. ✓ 288
D. 720

Answer: C

Each of the 6 lateral faces is an isosceles triangle with a base of 12 cm and a slant height of $\sqrt{10^2 - 6^2} = 8$ cm. The total lateral surface area is $6 \times (\frac{1}{2} \times 12 \times 8) = 288 \text{ cm}^2$.

15. If $\begin{pmatrix} 2 & -1 \\ a & 4 \end{pmatrix} \begin{pmatrix} 1 & b \\ -1 & 3 \end{pmatrix} = \begin{pmatrix} 3 & 1 \\ -1 & 18 \end{pmatrix}$ Then what are the values of a and b respectively? (1)
- A. ✓ 3, 2
B. 2, -2
C. -1, 2
D. 0, -1

Answer: A

Multiplying the matrices gives the system $2b - 3 = 1 \implies b = 2$ and $a - 4 = -1 \implies a = 3$.

16. Let $A = \begin{pmatrix} 1 & -1 \\ 0 & 2 \\ -3 & 6 \end{pmatrix}$ Then A^T is (1)

A. $\begin{pmatrix} 1 & 0 & -3 \\ -1 & 2 & 6 \end{pmatrix}$

B. $\begin{pmatrix} 1 & 0 \\ -1 & 2 \\ -3 & 6 \end{pmatrix}$

C. $\begin{pmatrix} -1 & 2 & 6 \\ 1 & 0 & 6 \end{pmatrix}$

D. $\begin{pmatrix} -1 & 1 \\ 2 & 0 \\ 6 & -3 \end{pmatrix}$

Answer: A

The transpose of a matrix A is formed by swapping its rows and columns, making the 3×2 matrix into a 2×3 matrix.

17. On the set of Natural numbers $\mathbb{N}$, which one of the following propositions has a truth value True ? (1)

A. $\checkmark (\exists x)(\exists y)(x - y = y - x)$

B. $(\forall x)(\forall y)(x \neq y \implies x > y)$

C. $(\forall x)(\exists y)(x - y = 5)$

D. $(\forall x)(\exists y)(xy < x)$

Answer: A

The statement $(\exists x)(\exists y)(x - y = y - x)$ is true on $\mathbb{N}$ because we can choose $x = y = 1$, which yields $1 - 1 = 1 - 1 = 0$.

18. In a certain month of the year, the temperature of a city was recorded and presented as follows: Temperature (in $^{\circ}\text{C}$) 10-14 15-19 20-24 25-29 30-34 Frequency (number of days) 2 9 11 5 3 Which one of the following is the cumulative frequency of the fourth class? (1)

A. 22

B. $\checkmark$ 27

C. 18

D. 20

Answer: B

The cumulative frequency of the fourth class is the sum of the frequencies of the first four classes: $2 + 9 + 11 + 5 = 27$.

19. A fair die is going to be rolled once, and let: E_1 be the event that an even number occurs; E_2 be the event that a prime number occurs; E_3 be the event that a multiple of 3 occurs; E_4 be the event that a multiple of 5 occurs; Then which of the following pairs of events are mutually exclusive? (1)

A. E_1 and E_3

B. $\checkmark$ E_3 and E_4

C. E_1 and E_2

D. E_2 and E_4

Answer: B

Two events are mutually exclusive if they cannot occur at the same time, meaning their intersection is empty. Since $E_3 = \{3, 6\}$ and $E_4 = \{5\}$ share no common outcomes, they are mutually exclusive.

20. The following is the distribution of the weight of 40 students in a certain class: Weight (in Kg) 40-48 49-57 58-66 67-75 76-84 f 8 18 7 5 2 Then for data given above, what is the median weight in kg? (1)

A. $\checkmark$ 54.5

B. 55

C. 53

D. 53.8

Answer: A

The total number of students is $N = 40$, so the median lies at the 20^{th} value, which falls in the class interval 49-57. Using the median formula $L + \left(\frac{N/2 - cf_{\text{prev}}}{f} \right) w = 48.5 + \left(\frac{20 - 8}{18} \right) \times 9 = 54.5$ Kg.

The angle θ between two lines with slopes $m_1 = 2$ and $m_2 = -3$ is given by $\tan \theta = \left| \frac{m_1 - m_2}{1 + m_1 m_2} \right| = \left| \frac{2 - (-3)}{1 + 2(-3)} \right| = 1$, which corresponds to $\theta = \pi/4$.

27. The equation of the parabola with vertex $V(2, -1)$ and focus $F(-1, -1)$ is (1)

- A. $(x + 1)^2 = -12(y + 1)$ B. ✓ $(y + 1)^2 = -12(x - 2)$
C. $(y + 1)^2 = 12(x - 2)$ D. $(x - 2)^2 = -12(y + 1)$

Answer: B

The parabola has a horizontal axis of symmetry since the vertex $V(2, -1)$ and focus $F(-1, -1)$ share the same y -coordinate. The focal distance is $p = -1 - 2 = -3$, so the equation is $(y - k)^2 = 4p(x - h) \Rightarrow (y + 1)^2 = -12(x - 2)$.

28. What is the value of $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 + 1}$? (1)

- A. 3 B. 1
C. 2 D. ✓ 0

Answer: D

Direct substitution of $x = 1$ into the rational expression yields $\frac{1^2 - 1}{1^2 + 1} = \frac{0}{2} = 0$.

29. Which one of the following is the value of a so that the function given by $f(x) = \begin{cases} ax + 1 & \text{for } x \geq 1 \\ x^2 - 4 & \text{for } x < 1 \end{cases}$ is continuous at 1? (1)

- A. 4 B. ✓ -4
C. -1 D. 1

Answer: B

For $f(x)$ to be continuous at $x = 1$, the left-hand limit must equal the right-hand limit: $\lim_{x \rightarrow 1^-} (x^2 - 4) = \lim_{x \rightarrow 1^+} (ax + 1) \Rightarrow -3 = a + 1 \Rightarrow a = -4$.

30. Let $f(x) = -\frac{1}{3} \cos\left(2x^3 - \frac{\pi}{3}\right) + 1$. Then what is the period and Phase shift of the graph of f respectively? (1)

- A. $4\pi/9$ and $2\pi/9$ B. ✓ $2\pi/3$ and $2\pi/9$
C. $3\pi/2$ and $4\pi/9$ D. $\pi/9$ and $4\pi/9$

Answer: B

Assuming a typographical error in the argument of the cosine term, the function is intended to be $f(x) = -\frac{1}{3} \cos\left(3x - \frac{2\pi}{3}\right) + 1$. Its period is $\frac{2\pi}{3}$ and its phase shift is $\frac{2\pi/3}{3} = \frac{2\pi}{9}$.

31. What is the fifth term of the sequence $\{2^n + 4n - 5\}_{n=0}^\infty$? (1)

- A. ✓ 27 B. 17
C. 47 D. 15

Answer: A

Since the sequence starts at $n = 0$, its fifth term corresponds to $n = 4$. Substituting $n = 4$ into the formula gives $2^4 + 4(4) - 5 = 16 + 16 - 5 = 27$.

32. Which one of the following numbers is the upper bounds of the sequence $\left\{\frac{2n+1}{n+1}\right\}_{n=1}^\infty$? (1)

- A. $3/2$ B. 0
C. 1 D. ✓ 4

Answer: D

The terms of the sequence are $a_n = 2 - \frac{1}{n+1}$, which strictly increases and approaches 2 as $n \rightarrow \infty$. Therefore, any value greater than or equal to 2 is an upper bound, making 4 the only correct choice among the options.

33. Let the sequence $\{a_n\}$ converges to 3 while $\{b_n\}$ converges to -1. Then the sequence $\{a_n - b_n\}$ converges to (1)
- A. 1
B. ✓ 4
C. 3
D. 1/3

Answer: B

Using the limit difference rule, $\lim_{n \rightarrow \infty} (a_n - b_n) = \lim_{n \rightarrow \infty} a_n - \lim_{n \rightarrow \infty} b_n = 3 - (-1) = 4$.

34. Which of the following argument is valid? (1)
- A. $p \vee q, p \Rightarrow q \vdash \neg q$
B. $p \Rightarrow q, q, r \Rightarrow p \vdash r$
C. ✓ $p, p \Rightarrow q, r \vee \neg q \vdash p \wedge r$
D. $p \Rightarrow q, \neg r \wedge q \vdash p \vee r$

Answer: C

From p and $p \Rightarrow q$, we derive q via Modus Ponens. Since q is true, $\neg q$ is false, so $r \vee \neg q$ implies r is true. Combining p and r yields $p \wedge r$, making the argument valid.

35. Which of the following assertions is true applying the Principle of Mathematical Induction? (1)
- A. ✓ $1 + 2 + 2^2 + \dots + 2^n = 2^{n+1} - 1$ for $n \geq 0$
B. $n! \geq 2^n$ for $n \geq 0$
C. $2 + 3 + 4 + \dots + n = \frac{n(n+1)}{2} + 1$ for $n \geq 2$
D. $3 + 5 + 7 + \dots + (2n + 1) = n^2$ for $n \geq 1$

Answer: A

Using mathematical induction on $n \geq 0$, the base case $n = 0$ gives $1 = 2^1 - 1$, which is true, and the inductive step adds 2^{k+1} to both sides, yielding $2^{k+2} - 1$, which confirms the statement is true for all $n \geq 0$.

36. Which of the following is equal to $\int 3\cos 3x dx$? (1)
- A. $\frac{1}{3} \sin 3x + c$
B. ✓ $\sin 3x + c$
C. $\sin x + c$
D. $-\sin x + c$

Answer: B

Using the substitution $u = 3x$, we have $du = 3dx$. Thus, $\int 3\cos(3x)dx = \int \cos(u)du = \sin(3x) + c$.

37. What is the area of the region bounded by the graph of $f(x) = x^2 - 4$ and the x-axis in square units? (1)
- A. 16
B. 32
C. 16/3
D. ✓ 32/3

Answer: D

The x-intercepts of $f(x) = x^2 - 4$ are $x = \pm 2$. Since the curve lies below the x-axis in this interval, the area is $\int_{-2}^2 (4 - x^2)dx = \left[4x - \frac{x^3}{3}\right]_{-2}^2 = \frac{32}{3}$.

38. Which of the following set of equations define the xz-plane? (1)
- A. $\{(x,y,z) | x,y,z \in \mathbb{R} \text{ and } x=0\}$
B. ✓ $\{(x,y,z) | x,y,z \in \mathbb{R} \text{ and } y=0\}$
C. $\{(x,y,z) | x,y,z \in \mathbb{R} \text{ and } x=0\}$
D. $\{(x,y,z) | x,y,z \in \mathbb{R} \text{ and } z=0\}$

Answer: B

The xz-plane consists of all points in 3D space where the y-coordinate is equal to zero, which is represented by the set $\{(x,y,z) | x,y,z \in \mathbb{R} \text{ and } y = 0\}$.

39. Which of the following functions has a graph that completes one full cycle on $[-\pi, \frac{11\pi}{4}]$? (1)

- A. $f(x) = 3 \sin(3x + \frac{\pi}{6})$ B. $f(x) = 3 \sin(\frac{4}{3}x + \frac{\pi}{2})$
 C. ✓ $f(x) = 2 \sin(\frac{2}{3}x - \frac{\pi}{6})$ D. $f(x) = 2 \sin(2x - \frac{\pi}{6})$

Answer: C

Assuming the interval is a typo for $[-\pi/4, 11\pi/4]$ (which has length 3π), a function completes one full cycle if its period is 3π . For $f(x) = 2 \sin(\frac{2}{3}x - \frac{\pi}{6})$, the period is $T = 2\pi/(2/3) = 3\pi$, which matches the interval length.

40. Let A be a square matrix of order n and let B be a matrix obtained by multiplying one row of A by 2 and C be a matrix found by adding one row of A to another row of A . If $\det(A) = 10$, what are $\det(B)$ and $\det(C)$? (1)

- A. ✓ **20 and 10** B. 20 and 0
 C. 10 and 20 D. 10 and 10

Answer: A

Multiplying one row of A by 2 multiplies the determinant by 2, so $\det(B) = 2 \times 10 = 20$. Adding one row to another does not change the determinant, so $\det(C) = \det(A) = 10$.

41. The solution set of the system $\begin{cases} 2x - y + 3z = 1 \\ x + y + 3z = 5 \\ x - y + z = -1 \end{cases}$ is (1)

- A. $\{(-4 - 2k, k, 2 - k) : k \in \mathbb{R}\}$ B. $\{(k + 1, 2k, k - 1) : k \in \mathbb{R}\}$
 C. ✓ $\{(2 - 2k, 3 - k, k) : k \in \mathbb{R}\}$ D. $\{(k, k + 1, k - 1) : k \in \mathbb{R}\}$

Answer: C

Substituting $x = 2 - 2k$, $y = 3 - k$, and $z = k$ into the system of equations yields $2(2 - 2k) - (3 - k) + 3k = 1$, $(2 - 2k) + (3 - k) + 3k = 5$, and $(2 - 2k) - (3 - k) + k = -1$, which are all true for any $k \in \mathbb{R}$.

42. Let z_1, z_2 , and z_3 be complex numbers. Then which of the following is NOT necessarily true? (1)

- A. $z_1 - (z_2 + z_3) = (z_1 - z_2) - z_3$ B. ✓ $z_1 - (z_2 - z_3) = (z_1 - z_2) - z_3$
 C. $(z_1 z_2) z_3 = (z_2 z_1) z_3$ D. $(z_1 z_2) z_3 = z_1 (z_2 z_3)$

Answer: B

The expression $z_1 - (z_2 - z_3)$ simplifies to $z_1 - z_2 + z_3$, which is not equal to $(z_1 - z_2) - z_3 = z_1 - z_2 - z_3$ unless $z_3 = 0$.

43. If a translation T takes a point $(-1, 1)$ to a point $(3, 2)$, then the image of the circle $x^2 + y^2 - 2x + 4y + 1 = 0$ under T is (1)

- A. $(x - 3)^2 + (y - 3)^2 = 4$ B. $(x - 2)^2 + (y + 3)^2 = 4$
 C. ✓ $(x - 5)^2 + (y + 1)^2 = 4$ D. $(x + 3)^2 + (y + 3)^2 = 4$

Answer: C

The translation vector is $T(x, y) = (x + 4, y + 1)$ because $T(-1, 1) = (3, 2)$. The original circle $(x - 1)^2 + (y + 2)^2 = 4$ has center $(1, -2)$, which under T translates to $(5, -1)$, giving the new equation $(x - 5)^2 + (y + 1)^2 = 4$.

44. Let $u = (-1, 6)$ and $v = (2, 4)$ be position vectors. Then the vector $4u - 3v$ is (1)

- A. ✓ **$(-10, 12)$** B. $(-10, 11)$
 C. $(-4, 24)$ D. $(-15, 18)$

Answer: A

We calculate $4u - 3v = 4(-1, 6) - 3(2, 4) = (-4, 24) - (6, 12) = (-10, 12)$.

45. Water is running into a canonical tank, which is pointed down at a constant rate of 6π cm³/sec. The cone has a height of 10 cm and a base radius of 5 cm, then how fast is the water level rising when the water reaches 2 cm deep? (1)

A. $\frac{4}{\pi}$ cm/sec
B. ✓ 6 cm/sec
C. 4 cm/sec
D. $\frac{6}{\pi}$ cm/sec

Answer: B

By similar triangles, $r = h/2$, so the volume is $V = \frac{\pi}{12}h^3$. Differentiating gives $\frac{dV}{dt} = \frac{\pi}{4}h^2\frac{dh}{dt}$, and substituting $\frac{dV}{dt} = 6\pi$ and $h = 2$ yields $6\pi = \pi\frac{dh}{dt} \implies \frac{dh}{dt} = 6$ cm/sec.

46. Let F be the anti-derivative of f . Then which of the following is NOT true about F and f ? (1)

A. $\frac{d}{dx} \int F(x) dx = f(x)$
B. $F'(x) = f(x)$
C. ✓ $\int F(x) dx = f(x) + c$
D. $\int \frac{d}{dx} f(x) dx = f(x) + c$

Answer: C

Since F is the antiderivative of f , we have $F'(x) = f(x)$ and $\int f(x) dx = F(x) + c$. Thus, the statement $\int F(x) dx = f(x) + c$ is false because it swaps the roles of f and F .

47. Let $f(x) = \frac{1}{\sqrt{x}}$ and $g(x) = 2 - \frac{1}{6}x^3$ be two functions. For what values of x do the graphs of f and g have tangent lines of the same slope? (1)

A. $\frac{\sqrt{3}}{2}$
B. ✓ 1
C. 4
D. 1/4

Answer: B

The slopes of the tangent lines are given by the derivatives $f'(x) = -\frac{1}{2}x^{-3/2}$ and $g'(x) = -\frac{1}{2}x^2$. Equating them gives $x^{-3/2} = x^2 \implies x^{7/2} = 1 \implies x = 1$.

48. What is the value of a number in the interval $(0, 1)$ that satisfies the Mean Value Theorem for the function $f(x) = 3x^2 - 5x + 1$? (1)

A. ✓ 1/2
B. 3/5
C. 5/6
D. 1

Answer: A

By the Mean Value Theorem, there is a $c \in (0, 1)$ such that $f'(c) = \frac{f(1)-f(0)}{1-0}$. Calculating $f'(c) = 6c - 5$ and $\frac{-1-1}{1} = -2$, we get $6c - 5 = -2 \implies c = 1/2$.

49. Let $f(x) = 3x + 2x - \sin x + e^x$. What is the value of $f'(0)$? (1)

A. ✓ 2
B. 1
C. -1
D. 4

Answer: A

Assuming the first term has a typo and is $3x^2$, we have $f(x) = 3x^2 + 2x - \sin x + e^x$. The derivative is $f'(x) = 6x + 2 - \cos x + e^x$, and evaluating at $x = 0$ gives $f'(0) = 0 + 2 - 1 + 1 = 2$.

50. Let f and g be differentiable functions, and $h(x) = g(f(3x + 1))$. If $f'(1) = f(1) = 2$ and $g'(2) = 1$, then what is the value of $h'(0)$? (1)

- A. 2
B. 1
C. ✓ 6
D. 4

Answer: C

Using the chain rule, $h'(x) = g'(f(3x + 1)) \cdot f'(3x + 1) \cdot 3$. At $x = 0$, this gives $h'(0) = g'(f(1)) \cdot f'(1) \cdot 3 = g'(2) \cdot f'(1) \cdot 3 = 1 \cdot 2 \cdot 3 = 6$.

51. Which of the following describes the mechanical meaning of derivative? (1)

- A. Gradient of graphs of functions
B. Area under the curve
C. ✓ **Instantaneous rate of change**
D. Slope of tangent line

Answer: C

The mechanical (or physical) interpretation of the derivative is the instantaneous rate of change of a quantity, such as velocity being the derivative of position.

52. Which of the following is true about the zero(s) of a function $f(x)$? (1)

- A. ✓ **If $f(a)=0$, then $x-a$ is a factor for $f(x)$.**
B. If $f(a)=0$, then $(x-a)^2$ is a factor of $f(x)$.
C. If $f(a)=0$, then a is not necessarily in the domain.
D. If $f(a)=0$, then $y=a$ is they-intercept.

Answer: A

By the Factor Theorem, if $f(a) = 0$ for a polynomial function $f(x)$, then $x - a$ is a factor of $f(x)$.

END OF THE MARKING KEY

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