

01 NUMBER & ALGEBRA

Easy

What is the sum of the first 10 terms of the arithmetic sequence 3, 7, 11, 15, ...?

A 210

B 205

C 215

D 220

02 NUMBER & ALGEBRA

Easy

The 5th term of a geometric sequence is 48 and the common ratio is 2. What is the first term?

A 3

B 4

C 6

D 2

03 NUMBER & ALGEBRA

Easy

Expand and simplify $(2x + 3)^2$.

A $4x^2 + 12x + 9$

B $4x^2 + 6x + 9$

C $4x^2 + 9$

D $2x^2 + 12x + 9$

Find the sum to infinity of the geometric series with first term 8 and common ratio $\frac{1}{3}$.

A 12

B 10

C 16

D 8

Using the binomial theorem, find the coefficient of x^3 in $(2 + x)^5$.

A 80

B 40

C 160

D 32

Solve: $\log_2(x) + \log_2(x - 2) = 3$.

A 4

B 2

C 8

D 6

What is the value of $\log_{10}(1000)$?

A 3

B 4

C 2

D 10

Express $\log_6(72)$ in terms of $\log_6(2)$ and $\log_6(3)$.

A $3\log_6 2 + 2\log_6 3$

B $2\log_6 2 + 3\log_6 3$

C $\log_6 2 + 2\log_6 3$

D $2\log_6 2 + \log_6 3$

In an arithmetic sequence, the sum of the first n terms is $S_n = 2n^2 + 5n$. What is the 8th term?

A 37

B 33

C 35

D 39

Find the constant term in the expansion of $(x - 2/x)^8$.

A 1120

B -1120

C 56

D -56

If $f(x) = 3x - 5$, what is $f^{-1}(x)$?

A $(x + 5)/3$

B $(x - 5)/3$

C $3x + 5$

D $x/3 - 5$

What is the range of $f(x) = x^2 + 2$?

A $y \geq 2$

B $y \geq 0$

C all reals

D $y > 2$

13 FUNCTIONS

Medium

The graph of $y = f(x)$ is shifted 3 units right and 2 units up. What is the new equation?

A $y = f(x-3) + 2$

B $y = f(x+3) + 2$

C $y = f(x-3) - 2$

D $y = f(x+3) - 2$

14 FUNCTIONS

Medium

Find the vertex of the parabola $y = 2x^2 - 8x + 5$.

A $(2, -3)$

B $(2, 5)$

C $(4, -3)$

D $(-2, -3)$

15 FUNCTIONS

Easy

Which transformation maps $y = e^x$ to $y = e^{-x}$?

A Reflection in the y-axis

B Reflection in the x-axis

C Shift left by 1

D Shift right by 1

If $f(x) = 2x$ and $g(x) = x + 3$, find $(f \circ g)(x)$.

A $2x + 6$

B $2x + 3$

C $2x^2 + 6$

D $x + 6$

The domain of $f(x) = \sqrt{9 - x^2}$ is:

A $-3 \leq x \leq 3$

B $x \geq 3$

C $x \leq 3$

D all reals

For $f(x) = (x+1)/(x-2)$, find the equations of the asymptotes.

A $x = 2, y = 1$

B $x = -1, y = 2$

C $x = 2, y = -1$

D $x = -2, y = 1$

19 FUNCTIONS

Hard

The function $f(x) = a^x$ passes through $(2, 9)$. What is a ?

A 3

B 9

C $1/3$

D 2

20 FUNCTIONS

Hard

If $f(x) = x^2 - 4x + k$ has exactly one x -intercept, what is k ?

A 4

B 0

C 2

D -4

21 GEOMETRY & TRIG

Easy

Convert 210° to radians.

A $7\pi/6$

B $5\pi/6$

C $7\pi/4$

D $5\pi/4$

In a right triangle with hypotenuse 13 and one leg 5, what is the other leg?

A 12

B 8

C 10

D 11

What is $\sin(\pi/6)$?

A $1/2$

B $\sqrt{2}/2$

C $\sqrt{3}/2$

D 1

Solve for x : $2\sin(x) = 1$, for $0 \leq x \leq 2\pi$.

A $\pi/6$ and $5\pi/6$

B $\pi/3$ and $2\pi/3$

C $\pi/4$ and $3\pi/4$

D $\pi/6$ and π

Using the cosine rule, find side a in triangle ABC where $b = 5$, $c = 7$, $A = 60^\circ$.

A $\sqrt{39}$

B $\sqrt{74}$

C $\sqrt{69}$

D 6

What is the area of a triangle with sides 6 and 8 and included angle 30° ?

A 12

B 24

C 48

D $6\sqrt{3}$

The equation of a circle centred at $(3, -2)$ with radius 5 is:

A $(x-3)^2 + (y+2)^2 = 25$

B $(x+3)^2 + (y-2)^2 = 25$

C $(x-3)^2 + (y-2)^2 = 25$

D $(x+3)^2 + (y+2)^2 = 25$

Simplify: $\sin^2(x) + \cos^2(x) + \tan^2(x)$.

A $\sec^2(x)$

B 1

C 2

D $1 + \sin^2(x)$

In triangle ABC: $a/\sin A = b/\sin B$. If $a = 8$, $A = 45^\circ$, $B = 75^\circ$, find b (to 3 s.f.).

A 10.9

B 11.3

C 9.66

D 8.00

The volume of a cone with radius $r = 4$ and height $h = 9$ is:

A 48π

B 144π

C 192π

D 36π

A bag has 4 red and 6 blue balls. One is drawn at random. $P(\text{red}) = ?$

A $2/5$

B $3/5$

C $4/6$

D $1/4$

The mean of 5, 8, 12, 15, 10 is:

A 10

B 11

C 9

D 12

If two events A and B are independent, then $P(A \cap B) = ?$

A $P(A) \cdot P(B)$

B $P(A) + P(B)$

C $P(A)/P(B)$

D $1 - P(A) \cdot P(B)$

$X \sim B(10, 0.3)$. Find $P(X = 3)$ to 3 s.f.

A 0.267

B 0.233

C 0.350

D 0.120

A normal distribution has $\mu = 50$ and $\sigma = 5$. $P(X < 60) \approx ?$

A 0.977

B 0.950

C 0.841

D 0.500

The correlation coefficient $r = -0.92$ indicates:

A Strong negative linear correlation

B Weak negative correlation

C Strong positive correlation

D No correlation

In a dataset, if every value is multiplied by 3, what happens to the standard deviation?

A Multiplied by 3

B Multiplied by 9

C Unchanged

D Added by 3

Bayes' Theorem: $P(A|B) = P(B|A) \cdot P(A) / P(B)$. $P(A) = 0.4$, $P(B|A) = 0.7$, $P(B) = 0.5$. Find $P(A|B)$.

A 0.56

B 0.70

C 0.28

D 0.40

$X \sim N(\mu, \sigma^2)$. The interquartile range of X is approximately:

A 1.35σ

B 2σ

C σ

D 0.67σ

In a Poisson distribution with $\lambda = 3$, find $P(X \leq 1)$ to 3 d.p.

A 0.199

B 0.050

C 0.149

D 0.368

Find dy/dx if $y = 4x^3 - 5x + 2$.

A $12x^2 - 5$

B $4x^2 - 5$

C $12x^2 + 2$

D $4x^3 - 5$

Evaluate $\int (2x + 3) dx$.

A $x^2 + 3x + C$

B $x^2 + C$

C $2x^2 + 3x + C$

D $x + 3 + C$

What is the gradient of the curve $y = x^2 - 3x$ at $x = 2$?

A 1

B 4

C -3

D 2

The function $f(x) = x^3 - 3x^2 - 9x + 5$ has local maxima and minima where $f'(x) = 0$. Find the x -values.

A $x = -1$ and $x = 3$

B $x = 1$ and $x = 3$

C $x = -3$ and $x = 1$

D $x = 1$ and $x = -3$

Evaluate $\int_0^2 (3x^2 - 2) \, dx$.

A 4

B 6

C 8

D 2

Find the equation of the tangent to $y = x^2$ at the point $(3, 9)$.

A $y = 6x - 9$

B $y = 6x + 9$

C $y = 3x - 9$

D $y = 9x - 18$

Differentiate $y = \sin(3x)$.

A $3\cos(3x)$

B $\cos(3x)$

C $-3\sin(3x)$

D $3\sin(3x)$

Differentiate $y = e^{(2x)}$.

A $2e^{(2x)}$

B $e^{(2x)}$

C $2xe^x$

D $e^{(2x)}/2$

Using integration by substitution, find $\int 2x \cdot e^{(x^2)} dx$.

A $e^{(x^2)} + C$

B $2e^{(x^2)} + C$

C $\frac{1}{2}e^{(x^2)} + C$

D $xe^{(x^2)} + C$

The area between $y = x^2$ and $y = x$ is:

A $\frac{1}{6}$

B $\frac{1}{3}$

C $\frac{1}{2}$

D $\frac{1}{4}$

Differentiate $y = \ln(x^2 + 1)$.

A $2x/(x^2+1)$

B $1/(x^2+1)$

C $2/(x+1)$

D $\ln(2x)$

Find the x-coordinate of the inflection point of $f(x) = x^3 - 6x^2$.

A 2

B -2

C 3

D 6

The graph of $y = |x - 2|$ has a vertex (minimum) at:

A (2, 0)

B (0, 2)

C (-2, 0)

D (2, 2)

$P(A) = 0.6$, $P(B) = 0.4$, $P(A \cup B) = 0.76$. Are A and B independent?

A Yes

B No

C Cannot determine

D Only if mutually exclusive

Find the number of terms in the geometric sequence 2, 6, 18, ..., 1458.

A 6

B 7

C 5

D 8

What is the exact value of $\cos(150^\circ)$?

A $-\sqrt{3}/2$

B $\sqrt{3}/2$

C $-1/2$

D $1/2$

In linear regression $\hat{y} = 2.3x + 4.1$, when $x = 5$, the predicted value is:

A 15.6

B 11.5

C 19.7

D 10.1

If $f(x) = \cos(x)$, what is $f'(x)$?

A $-\cos(x)$

B $\cos(x)$

C $\sin(x)$

D $-\sin(x)$

The period of $y = \sin(2x)$ is:

A π

B 2π

C $\pi/2$

D 4π

Solve: $4^x = 32$.

A $5/2$

B $2/5$

C 5

D 2

61 GEOMETRY & TRIG

Hard

A sector has radius 8 cm and arc length 12 cm. Its area is:

A 48 cm²

B 96 cm²

C 24 cm²

D 64 cm²

62 CALCULUS

Hard

Evaluate $\int_1^3 1/x \, dx$ to 3 s.f.

A 1.10

B 0.693

C 1.61

D 2.20

63 STATISTICS & PROB

Hard

A sample of 50 has mean 24 and standard deviation 4. A 95% confidence interval for μ is approximately:

A 22.9 to 25.1

B 20 to 28

C 23 to 25

D 22 to 26

Which of the following is the correct sketch of $y = -(x - 1)^2 + 4$?

A Downward parabola, vertex at (1, 4)

B Upward parabola, vertex at (1, 4)

C Downward parabola, vertex at (-1, 4)

D Upward parabola, vertex at (-1, -4)

How many ways can 5 students be arranged in a line?

A 120

B 20

C 60

D 100

How many ways can 3 books be chosen from 8 (order doesn't matter)?

A 56

B 336

C 24

D 512

The angle subtended by arc AB at the centre is $2\times$ the angle subtended at the circumference. If the central angle is 80° , the inscribed angle is:

A 40°

B 160°

C 80°

D 20°

Find the maximum value of $f(x) = -x^2 + 4x - 1$.

A 3

B 4

C -1

D 5

The median of 2, 5, 7, 9, 12 is:

A 7

B 6

C 8

D 5

A hypothesis test gives $p\text{-value} = 0.03$ and $\alpha = 0.05$. The conclusion is:

- A Reject H_0
- B Do not reject H_0
- C Accept H_1 at 1% level
- D No conclusion possible

The function $f(x) = 2^x - 1$ has a horizontal asymptote at:

- A $y = -1$
- B $y = 0$
- C $y = 1$
- D $y = 2$

Find all solutions to $\cos(2x) = 0$ on $[0, 2\pi]$.

- A $\pi/4, 3\pi/4, 5\pi/4, 7\pi/4$
- B $\pi/2$ and $3\pi/2$
- C $\pi/4$ and $3\pi/4$
- D $0, \pi/2, \pi, 3\pi/2$

Simplify: $(3 + 2i)(3 - 2i)$.

A 13

B 5

C $9 + 4i$

D $6 - 4i^2$

Convert $3 + 4i$ to polar form.

A $5(\cos \theta + i \sin \theta), \theta = \arctan(4/3)$

B $5 + \arctan(4/3)i$

C $(3,4)$

D $\sqrt{7} \operatorname{cis}(\arctan 4/3)$

Use the product rule to differentiate $y = x^2 \cdot e^x$.

A $e^x(x^2 + 2x)$

B $2x \cdot e^x$

C $x^2 \cdot e^x + e^x$

D $x^2 e^x / 2$

In a χ^2 goodness-of-fit test with 4 categories, the degrees of freedom is:

A 3

B 4

C 5

D 2

$\int \sin(x) \cdot \cos(x) \, dx = ?$

A $\sin^2(x)/2 + C$

B $-\cos(x) + C$

C $\sin(x)\cos(x) + C$

D $-\sin^2(x)/2 + C$

If $f(x) = x^2$ and $g(x) = 2x - 1$, find $g(f(3))$.

A 17

B 8

C 17

D 35

The variance of the data set $\{2, 4, 4, 4, 5, 5, 7, 9\}$ is:

A 4

B 2

C 16

D 3

Convert the rectangular point $(-3, 3)$ to polar form.

A $(3\sqrt{2}, 135^\circ)$

B $(3\sqrt{2}, 45^\circ)$

C $(6, 120^\circ)$

D $(3, 135^\circ)$

The rate of change of volume $V = \frac{4}{3}\pi r^3$ with respect to r when $r = 3$ is:

A 36π

B 12π

C 108π

D 4π

The modulus of the complex number $z = 5 - 12i$ is:

A 13

B 7

C 17

D $\sqrt{119}$

In a t-test, the test statistic is $t = (\bar{x} - \mu_0)/(s/\sqrt{n})$. If $\bar{x} = 52$, $\mu_0 = 50$, $s = 8$, $n = 16$, then $t = ?$

A 1

B 2

C 0.5

D 4

For $f(x) = 3/(x+2)$, the vertical asymptote is $x = -2$. What is the horizontal asymptote?

A $y = 0$

B $y = 3$

C $y = 2$

D $y = -2$

Two forces of 6 N and 8 N act at right angles. The magnitude of the resultant is:

A 10 N

B 14 N

C 2 N

D 48 N

The equation of the normal to $y = x^3$ at $(2, 8)$ is:

A $y = -x/12 + 25/3$

B $y = 12x - 16$

C $y = x/12 + 8$

D $y = -12x + 32$

For a discrete random variable: $P(X=0) = 0.2$, $P(X=1) = 0.5$, $P(X=2) = 0.3$. $E(X) = ?$

A 1.1

B 0.5

C 1.0

D 1.5

Solve for z : $z^2 + 2z + 5 = 0$.

A $z = -1 \pm 2i$

B $z = 1 \pm 2i$

C $z = -2 \pm i$

D $z = \pm 2i$

In a circle of radius 5, a chord is 6 cm from the centre. The length of the chord is:

A 8

B 4

C $6\sqrt{2}$

D 10

The inverse of $f(x) = e^{(2x)}$ is:

A $f^{-1}(x) = \ln(x)/2$

B $f^{-1}(x) = \ln(2x)$

C $f^{-1}(x) = 2\ln(x)$

D $f^{-1}(x) = e^x/2$

Find $\int x \cdot \ln(x) \, dx$.

A $x^2 \ln(x)/2 - x^2/4 + C$

B $x^2/2 + C$

C $\ln(x)/x + C$

D $x \cdot \ln(x) - x + C$

The regression line passes through $(\bar{x}, \bar{y})$. If $\bar{x} = 4$ and $\bar{y} = 11$ and slope $b = 2$, what is the y-intercept?

A 3

B 7

C -3

D 11

The distance between points A(1, 2, 3) and B(4, 6, 3) in 3D is:

A 5

B 7

C $\sqrt{34}$

D $\sqrt{50}$

If $z = 2(\cos 60^\circ + i \sin 60^\circ)$, find z^2 .

A $4(\cos 120^\circ + i \sin 120^\circ)$

B $2(\cos 120^\circ + i \sin 120^\circ)$

C $4(\cos 30^\circ + i \sin 30^\circ)$

D $8 \operatorname{cis} 120^\circ$

The acceleration of a particle at time t is $a = 6t$. If $v = 4$ when $t = 0$, find v at $t = 3$.

A 31

B 18

C 27

D 13

In a normal distribution, approximately what percentage of values lie within 2 standard deviations of the mean?

A 95%

B 68%

C 99.7%

D 90%

If $f(x) = x - 1$ and $g(x) = x^2$, find $(g \circ f)(3)$.

A 4

B 8

C 9

D 5

The coefficient of x^2 in the expansion of $(1 + x)^6$ is:

A 15

B 6

C 21

D 10

The surface area of a sphere with radius 4 is:

A 64π

B 32π

C 16π

D $256\pi/3$

Find dy/dx using implicit differentiation if $x^2 + y^2 = 25$.

A $-x/y$

B x/y

C $-y/x$

D y/x

Answer Key

1. A	2. A	3. A	4. A	5. A
6. A	7. A	8. A	9. A	10. A
11. A	12. A	13. A	14. A	15. A
16. A	17. A	18. A	19. A	20. A
21. A	22. A	23. A	24. A	25. A
26. A	27. A	28. A	29. A	30. A
31. A	32. A	33. A	34. A	35. A
36. A	37. A	38. A	39. A	40. A
41. A	42. A	43. A	44. A	45. A
46. A	47. A	48. A	49. A	50. A
51. A	52. A	53. A	54. A	55. A
56. A	57. A	58. A	59. A	60. A
61. A	62. A	63. A	64. A	65. A
66. A	67. A	68. A	69. A	70. A
71. A	72. A	73. A	74. A	75. A
76. A	77. A	78. A	79. A	80. A
81. A	82. A	83. A	84. A	85. A
86. A	87. A	88. A	89. A	90. A
91. A	92. A	93. A	94. A	95. A
96. A	97. A	98. A	99. A	100. A