

A-Level Further Mathematics

Name: _____ Score: _____

1. For $x^2 - 5x + 6 = 0$, what is the sum of the roots $\alpha + \beta = -b/a$?

2. A rational function has an oblique (slant) asymptote when the degree of the top is:

☐ higher than the degree of the bottom☐ lower than the bottom☐ equal to the bottom☐ always zero

3. Using $\Sigma r = \frac{1}{2}n(n+1)$, what is the sum of the first 5 integers?

4. What is the determinant of the matrix $\begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$ ($ad - bc$)?

5. In polar coordinates, the x-coordinate is given by:

☐ $r \cos \theta$ ☐ $r \sin \theta$ ☐ $r \tan \theta$ ☐ r / θ

6. The vector product $\mathbf{a} \times \mathbf{b}$ gives a vector that is:

☐ perpendicular to both $\mathbf{a}$ and $\mathbf{b}$ ☐ parallel to $\mathbf{a}$ ☐ equal to $\mathbf{a} + \mathbf{b}$ ☐ a scalar

7. The two steps of proof by induction are the base case and the:

☐ inductive step (assume $n = k$, prove $n = k + 1$)☐ final check at $n = 100$ ☐ differentiation step☐ substitution

8. For $x^2 - 5x + 6 = 0$, what is the product $\alpha\beta = c/a$?

9. You find an oblique asymptote by:

- ☐ dividing the top polynomial by the bottom
- ☐ differentiating
- ☐ setting $x = 0$
- ☐ taking the modulus

10. Using $\Sigma r^2 = (1/6)n(n+1)(2n+1)$, what is the sum of the first 3 squares?

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1. 5

$$\alpha + \beta = -b/a = -(-5)/1 = 5.$$

2. higher than the degree of the bottom

When the numerator's degree exceeds the denominator's, dividing out leaves a slant line the curve approaches.

3. 15

$$\frac{1}{2} \times 5 \times 6 = 15 \quad (= 1+2+3+4+5).$$

4. 10

$$\det = 3 \times 4 - 1 \times 2 = 12 - 2 = 10.$$

5. $r \cos \theta$

$$x = r \cos \theta \text{ and } y = r \sin \theta.$$

6. perpendicular to both $\mathbf{a}$ and $\mathbf{b}$

$\mathbf{a} \times \mathbf{b}$ is perpendicular to both vectors; its length is $|\mathbf{a}||\mathbf{b}|\sin \theta$.

7. inductive step (assume $n = k$, prove $n = k + 1$)

Induction needs a base case plus an inductive step from k to $k+1$.

8. 6

$$\alpha\beta = c/a = 6/1 = 6.$$

9. dividing the top polynomial by the bottom

Polynomial division gives the straight-line part the curve approaches far from the origin.

10. 14

$$(1/6)(3)(4)(7) = 84/6 = 14 \quad (= 1+4+9).$$