Paper 1 mathematics Item Bank.

Af Education Services.

0759336820

Note: Our Book has over 1,500 well organised items per topic and per construct.

This is only paper 1, we're still working on paper 2. (VERY SOON)

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Chapter 1: Numerical Concept.

Item 1.

Your father is a civil engineer. His firm is preparing the design and cost estimates for a new water supply system that will serve several surrounding communities. In the first of their designs, three quantities x, y, z, were introduced to represent different parameters in the pumping system. The engineers found that $3^x = 5^y = 75^z$. The chief engineer explained that this relationship should imply that $xz = z(2x + y)$, but the design team has failed to prove whether the statement is correct. (0759336820)

In the finance department, two cost variables a and b were used to represent the expenditure on pipes and storage tanks. Financial analysis showed that $a^2 + b^2 = 7ab$. The project accountant stated that this condition would lead to the logarithmic result $\log[\frac{1}{3}(a + b)] = \frac{1}{2}(\log a + \log b)$ but the accounts department has not yet justified the claim. (0759336820)

In the procurement department, the quantity $\frac{1}{1+\sqrt{2}-\sqrt{3}}$ appeared in a formula used to estimate material efficiency. For the value to be entered into the design software, it must first be expressed as an equivalent fraction with a rational denominator.

Tasks:

Help your father's engineering firm to:

a) verify whether the relationship between the flow parameters is true;

b) prove whether the accountant's logarithmic statement is valid; and

c) express the efficiency quantity as an equivalent fraction with a rational denominator. (0759336820)

Chapter 2: Equations and Inequalities

Item 1.

Arise and Shine maize millers ltd is planning to expand its production capacity to meet growing demand. One of the grinding machines is modelled by the polynomial $f(x) = 3 - 7x + 5x^2 - x^3$. The machine supplier stated that $3 - x$ is a factor of $f(x)$. After factorizing the polynomial completely, the manager must determine all values of x for which $f(x) \leq 0$. These values will indicate the range within which the machine can operate safely. **(0759336820)**

The same company uses another production model represented by the polynomial $f(x) = 2x^4 + x^3 - x^2 + 8x - 4$. The planning officer needs to express this polynomial as the product of two linear factors and a quadratic factor $q(x)$. To confirm that the model will remain stable for all real operating conditions, the officer must also prove that there are no real values of x for which $q(x) = 0$. **(0759336820)**

Their accountant is also studying the quadratic equation $x^2 - x + k = 0$ where k is a constant used in the company's cost model. It is known that one root of the equation is twice the other. The accountant must determine both the roots and the corresponding value of k before completing the financial projections.

Tasks:

Help this maize milling company to:

a) verify the stated factor, factorize the machine performance polynomial completely and determine the values of x for which the machine operates within the required range;

b) express the second production model in the required factorized form and prove that the quadratic factor has no real roots;

c) determine the roots of the accounting equation and the value of the constant k. **(0759336820)**

Chapter 3: Coordinate Geometry 1

Item 1.

Dot com, a road construction company has been contracted to design and mark out a new triangular roundabout at the junction of three major roads leading to nearby trading centres. Two existing road markers are located at the points (1,2) and (5,4). The engineers plan to construct a drainage channel along the perpendicular bisector of the line joining these two markers. This drainage channel will meet the y −axis at the point $(0, k)$, where k represents the level at which a culvert will be installed. The design office has not yet determined the value of k. **(0759336820)**

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Further along the proposed roundabout, two additional reference points are given by A(-1,2) and B(-9,14). A point C is to be placed on the line joining A and B such that $\frac{AC}{CB} = \frac{1}{3}$. This point will serve as the location of a traffic control island. The engineers must also determine the equation of the road passing through A that is perpendicular to the line AB, since this road will connect the roundabout to a nearby market. **(0759336820)**

The three roads that form the boundaries of the roundabout are represented by the equations $x - 2y + 1 = 0, 9x + 2y - 11 = 0$ and $7x + 6y - 53 = 0$. The consulting engineer believes that the triangle enclosed by these roads is isosceles and needs to know the smallest angle of the triangle, correct to the nearest degree, before approving the final design. **(0759336820)**

Tasks:

Help Dot Com construction company to:

a) determine the coordinate where the culvert will be installed.

b) locate the coordinates of point C and find the equation of the road through A perpendicular to AB.

c) verify that the triangular roundabout is isosceles and calculate its smallest angle to the nearest degree.

Chapter 4: Partial Fractions

Item 1.

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