THE SCIENCE ACADEMY

S3 A-MATH E-TRIAL

O LEVEL ADDITIONAL MATHEMATICS

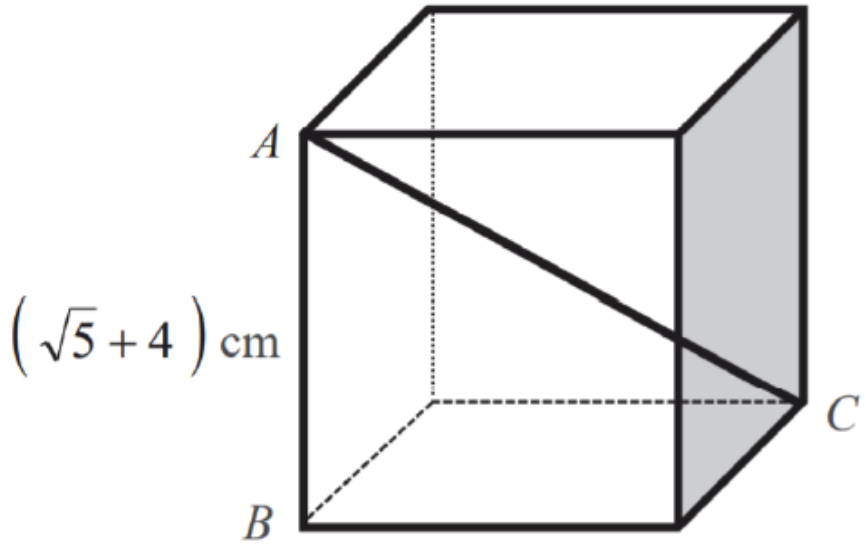
THE SCIENCE ACADEMY

QUADRATIC EQUATIONS

Find the greatest prime value of k for which $x^2 + 6x = 2kx + 25$ is always positive for all real values of x.

SURDS

The diagram below shows a cuboid with a square base. The height AB of the cuboid is $\left(\sqrt{5}+4\right)$ cm. Given that the length of the diagonal AC is $\frac{41\sqrt{5}}{3\sqrt{5}+2}$ cm,



SURDS

(a) Find an expression for BC^2 in the form $c + d\sqrt{5}$, where c and d are integers.

(b) Hence, find the area of the square base in the exact form

EXPONENTIAL AND LOGARITHMS

Peter is currently ill and was given an injection by his doctor. The rate that the drug is absorbed by the body after t hours is given by $C(t) = ke^{-0.45t}$, where k is a constant.

Just after the drug is injected, the concentration is 1.5 mg/ml.

(a) Find the value of k.

(b) What is the amount of drug absorbed by his body after 3 hours.

(c) It is poisonous if the concentration of drug in the body exceeds 1.7mg/ml at any given time. If the firs round of injection was administered at 12 pm, will it be safe for the doctor to administer the second round at 4 pm?

EXPONENTIAL AND LOGARITHMS

(c) It is poisonous if the concentration of drug in the body exceeds 1.7mg/ml at any given time. If the firs round of injection was administered at 12 pm, will it be

(iv) Is it possible for the concentration of drug in the body to reach 0 mg/ml? Explain.

EXPONENTIAL AND LOGARITHMS

Solve the simultaneous equations

$$0.5^{x}\left(4^{3y}\right) = 16$$

$$\log_4 2x + \log_4(x + 3y) = 1$$

REMAINDER THEOREM

The polynomial $f(x)$ is such that $f(x) = 3x^3 + ax^2 + bx + c$, where a, b and c are constants, is divisible by $x - 1$ but leaves a remainder of 3 when divided by $x + 2$.

Show that $a - b = 10$

PARTIAL FRACTIONS

Express $\frac{6x^2-3x-2}{(x+1)(x-1)^2}$ as the sum of 3 partial fractions.

BINOMIAL THEOREM

(a) By considering the general term in the binomial expansion of $\left(x^2+\frac{2}{x}\right)^{15}$,

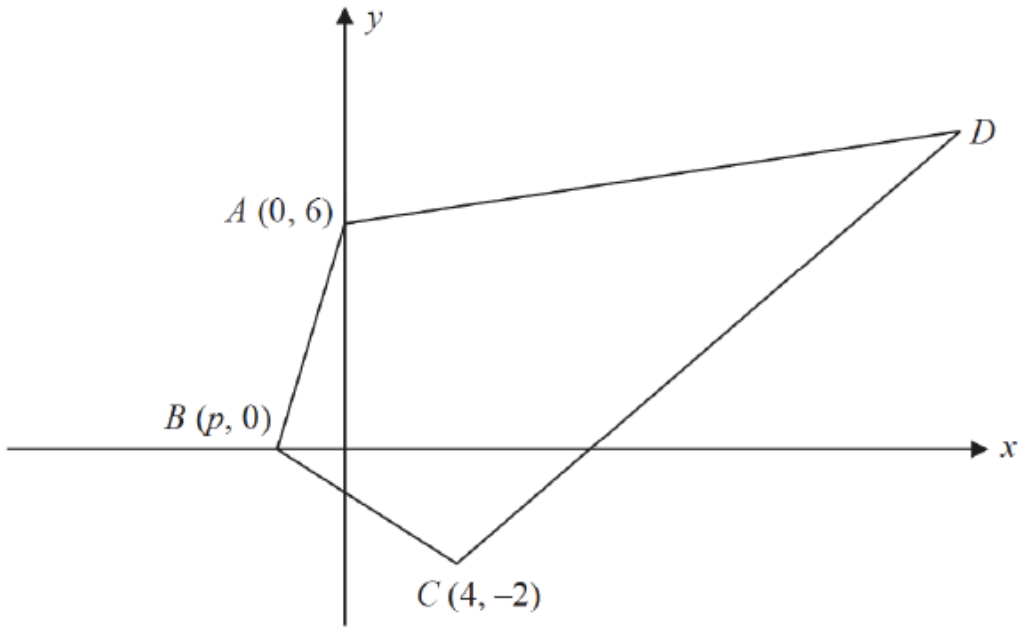
explain why all of the powers of x in this expansion are multiples of 3.

(b) Find the coefficient of x^{22} in the expansion of $\left(3x+\frac{1}{x^2}\right)\left(x^2+\frac{2}{x}\right)^{15}$

COORDINATE GEOMETRY

The figure below shows a kite with vertices $A(0, 6)$, $B(p, 0)$, $C(4, -2)$ and D, where

$AB = CB$ and $AD = CD$.



COORDINATE GEOMETRY

(a) Find the equation of line BD.

(b) Find the value of p.

(c) Given that the area of the kite $ABCD$ is 70 units^2, find the coordinates of D.