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Rich Starting Points – for A Level Pure Mathematics

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Risp 1: Triangle Number Differences

Pick two whole numbers between 1 and 10 inclusive, and call them a and b.

Say that T_n is the nth triangle number. Find T_a and T_b.

What is the difference between T_a and T_b? Is this a prime number?

When is the difference between two triangle numbers prime?

Risp 9: A Circle Property

I'm going to pick a number, let's say...12.

Now you pick two numbers, let's call them p and q, that multiply to 12.

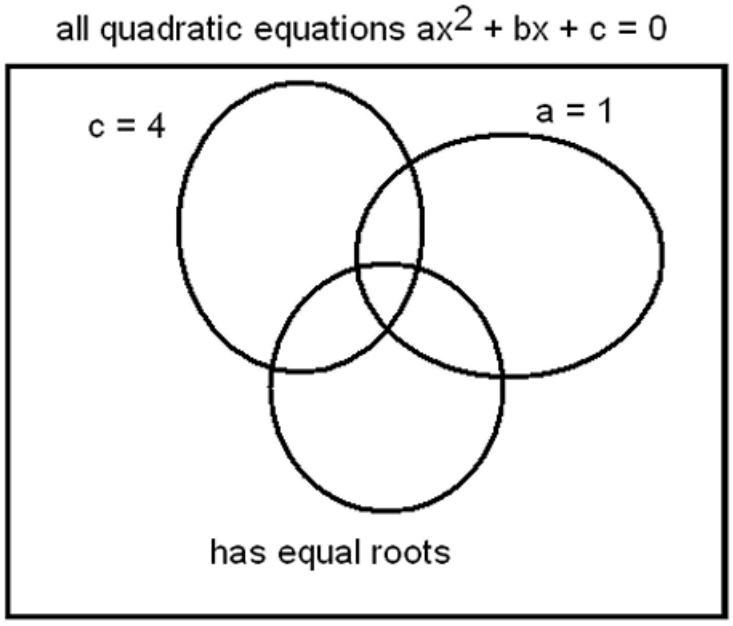
Now pick two numbers, call them s and t, that multiply to -12.

Now plot the point A = (p, s) and the point B = (q, t),
and draw the circle that has AB as diameter.

Do you notice anything unusual about your circle?
Can you find the equation of your circle? Does this confirm your findings?

What happens if we change the starting number?
Can you make any conjectures? Can you prove them?

Risp 10: Venn Diagrams



Can you find a quadratic equation for each of the eight regions above?

Risp 19: Extending the Binomial Theorem

Pick an odd number greater than 1, and call it n.

Take the numbers 1, -1, and n,
and place them into the square below in some order. (No repeats!)

$$(\square + \square x)^{\frac{1}{\square}}$$

How many orders are there?

Write down an expression for each order.

Find the first two terms of the expansion of each expression.
(That is, find the constant term and the term in x.)
Now add your expansions together to give, let's say, A + Bx.

Work out A/B + n. What do you get?

Will this always work? Can you prove it?

Risp 4: Periodic Functions

Given a periodic function f(x), let us call its period "per(f)".

Pick two prime numbers p and q.
If per(f) = p, and per(g) = q, what is per(f + g)?

If you add two periodic functions, do you always get a periodic function?

Suppose that f and g are periodic functions.
Are the following statements always true, sometimes true or never true?

1. per(f x g) = per(f) x per(g)
2. per (kf) = k per(f)

3. per (f + g) = per (f) + per (g) [hard!]

If you try these activities with your students and can give me any feedback,

I would be really grateful.

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