Risp 29: Teacher Notes

Suggested use: to consolidate/revise anything!

Gatsby Teacher Fellows are wisely given a mentor to shepherd them through their project year. I was fortunate enough to be given two mentors (did I look particularly helpless?), Bernard Murphy, leader of the Teaching Advanced Mathematics initiative and CPD Coordinator at MEI, and Susan Wall, ex-Head of Mathematics at Wilberforce College and a major author for the Standards Unit *Excellence for All* materials. Bernard was a welcome visitor in the lesson where I used this **Odd One Out** risp for the first time. (The Odd One Out technique is explored in *Improving Learning in Mathematics: Challenges and Strategies,* by Malcolm Swan (see Risp Books).

I felt the need to warn Bernard about the group in advance. They fell neatly into the Wise Virgins and the Foolish Virgins. The former were always on time, never missed a homework, and came to extra sessions of their own volition, Whilst the latter would wander in late, lose vital sheets as soon as they were given them, and produce work only after sustained and wearying pressure from myself. I wondered whether the membership of the two groups would be as obvious to Bernard as it was to me.

As my students began work, something marvellous happened. They were ALL drawn in to the activity, they ALL became animated, they ALL began to conjecture and brainstorm and share their knowledge or lack of it, without fear or embarrassment. Perhaps the Wise Virgins were more technically able, but the Foolish Virgins made up for this by being quicker to take risks. I was left reflecting that a good risp is a leveller. Bernard came up to me half way through with a smile on his face. "I can't tell who's who!"

Odd One Out – Possible Answers

Triplet 1:

$\sin(180 - x) = \sin x$, $\cos(180 - x) = -\cos x$, $\tan(180 - x) = -\tan x$
OR $\sin x$ is product of the other two, whilst the others are not
$\cos x$ is even, whilst $\sin x$ and $\tan x$ are odd
OR $\cos(0) = 1$, whilst $\sin(0) = \tan(0) = 0$
$\tan x$ has period = 180, the others have period 360
OR $\tan x$ is unbounded while others are bounded functions
OR $\tan 45 = 1$, whilst $\sin 45 = \cos 45 = 1/\sqrt{2}$

Triplet 2:
e^x differentiates to itself, the others don't
ln x can be negative, whilst e^x and x^2 are always non-negative
OR ln x has a graph that does not cut the graphs of the other functions
OR ln x is undefined for x negative, whilst the others are
x^2 can have negative gradient, whilst the others always have a positive gradient
OR x^2 is not the inverse of either of the others
OR x^2 goes through the origin whilst the others do not
OR x^2 even whilst the others are not
OR x^2 many-1 whilst others are 1-1

Triplet 3:
$\sqrt{2}\underline{i}$ has no $\underline{j}$ component
$\underline{i} + \underline{j}$ is sum of the other two
$(1-\sqrt{2})\underline{i} + \underline{j}$ does not have modulus $\sqrt{2}$

Triplet 4:
cos 2x can be written in three ways
sin 2x is 0 when x = 0, the others are both 1
cos x + sin x has period 360, the others have period 180
OR can be bigger than 1, whilst the other functions cannot

Triplet 5:
y = x has constant gradient, the others do not
$y = x^2$ is even, the other two are odd
OR x^2 is many-to-1, the others are 1-to-1
$y = x^3$ has a point of inflection, the other two do not
OR x^3 is the product of the other two, whilst the others are not

Triplet 6:
(cos t, 1 + sin t) is bounded
$(t, t^2 + 3)$ does not go through the origin
(t, 3t) can go below the x-axis

Triplet 7:
$\sqrt{2}(1 - 2x)^2 = \sqrt{2} - 4\sqrt{2}x + 4\sqrt{2}x^2$ (finite expansion)
$(1 + 2x)^{-1} = 1 - 2x + 4x^2 + \ldots$ (does not start with $\sqrt{2}$)
$(2 - x)^{1/2} = \sqrt{2} - \frac{\sqrt{2}}{4}x - \frac{\sqrt{2}}{32}x^2 + \ldots$ (x^2 coefficient is –ve)

Triplet 8:
$\sec^2 x$ integrates to an exact trig function
-1 is always negative, the others are always non-negative
$\tan^2 x$ is sum of the other two

Triplet 9:
$\underline{i}$ is a vector, the others are not
$\underline{i}.\underline{j}$ is a scalar, the others are not
$\underline{i}.\underline{j}.\underline{k}$ is meaningless, the others are not

Triplet 10:
$\underline{r} = \underline{i} + a\underline{j}$ (direction of this line is $\underline{j}$, other two lines have direction $\underline{i} - \underline{j}$)
$\underline{r} = b(\underline{i} - \underline{j})$ (goes through the origin, the other two do not)
$\underline{r} = \underline{k} + c(\underline{j} - \underline{i})$ (does not meet the either of other two lines, the other two do meet)