**Information on 2021/22 Bridging Mathematics for University Sessions for Y13 students**

**Gwybodaeth am Sesiynau 2021/22 Pontio Mathemateg i Brifysgol ar gyfer myfyrwyr Bl 13**

FMSP Wales is running an exciting series of pre-recorded presentations which will enable year 13 students to bridge towards studying mathematics at university. There is rarely time during the school teaching framework to see how differential equations can be used to model epidemics; or to investigate how complex numbers generate the amazing Mandelbrot set.  The present course is an opportunity to link up with Higher Education to benefit from their deep knowledge of the subject and their intimate familiarity with university-level mathematics. The programme is recommended to any students considering taking a maths-rich degree. Each session will be pre-recorded and approximately 30 minutes long. They will be released weekly from Tuesday 4th Nov 2021, and each made available for 2 weeks. There will be an opportunity for students to ask the lecturer questions about the presentation by email, and the lecturer will release a video response to selected questions, in the second week.

Mae RhGMB Cymru yn cynnal cyfres gyffrous o gyflwyniadau wedi'u recordio ymlaen llaw a fydd yn galluogi myfyrwyr blwyddyn 13 i bontio tuag at astudio mathemateg yn y brifysgol. Anaml y bydd amser yn ystod y fframwaith addysgu ysgolion i weld sut y gellir defnyddio hafaliadau differol i fodelu epidemigau; neu i ymchwilio i sut mae rhifau cymhlyg yn cynhyrchu'r set anhygoel Mandelbrot. Dyma gyfle prin i gysylltu ag Addysg Uwch i elwa ar eu gwybodaeth ddofn o'r pwnc a'u cyfarwydd-deb â mathemateg ar lefel prifysgol. Mae’r rhaglen yn cael ei argymell i unrhyw fyfyrwyr sy'n ystyried cymryd gradd sy’n cynnwys llawer o fathemateg. Bydd pob sesiwn yn cael ei recordio ymlaen llaw ac oddeutu 30 munud o hyd. Byddant yn cael eu rhyddhau yn wythnosol o ddydd Mawrth 4ydd o Dachwedd a phob un ar gael am bythefnos. Bydd cyfle i fyfyrwyr ofyn cwestiynau i'r darlithydd am y cyflwyniad trwy e-bost, a bydd y darlithydd yn rhyddhau ymateb fideo i gwestiynau dethol, yn yr ail wythnos.

This timetable is provisional, and the exact topics and dates may change.

Mae'r amserlen hon yn un dros dro a gall yr union bynciau newid.

*Thursday:, , , Mar 31st*

***4 Nov 2021: “Mountaineering Monks, Pancakes and Continuous Functions:  The Intermediate Value Theorem and Some Existence Proofs” by Professor Elaine Crooks, Swansea University.***

This talk will centre on the famous Intermediate Value Theorem one of the key results that students encounter in introductory analysis courses at university, and will introduce concepts such as continuous functions, existence theorems, and completeness of the real numbers, alongside applications ranging from monks meeting on mountain paths to equitable division of pancakes.

*New concepts*: Continuous function, Intermediate Value Theorem, Bisection of shapes, antipodal points, Bursak-Ulam Theorem, completeness of the real line.

*Useful for undergraduate modules*: Foundations of Mathematics, Real Analysis.

The talk will be delivered in English.

***4 Tach 2021: “Mynachod Mynydda, Crempogau a Ffwythiannau Parhaus: Y Theorem Gwerth Canolradd a Phrofion Bodolaeth” gan Yr Athro Elaine Crooks, Prifysgol Abertawe***

Bydd y sgwrs hon yn canolbwyntio ar y Theorem Gwerth Canolradd enwog, un o'r canlyniadau allweddol y mae myfyrwyr yn dod ar eu traws mewn cyrsiau dadansoddi rhagarweiniol yn y brifysgol, a bydd yn cyflwyno cysyniadau fel ffwythiannau parhaus, theoremau bodolaeth, a chyflawnder rhifau go iawn, ochr yn ochr â cheisiadau sy'n amrywio o gyfarfod mynachod ar lwybrau mynydd i rannu crempogau yn deg.

*Cysyniadau newydd*: Ffwythiannau parhaus, Theorem Gwerth Canolraddol, Rhaniad siapiau, pwyntiau gwrthffodal, Theorem Bursak-Ulam, cyflawnrwydd y llinell go iawn.

*Yn ddefnyddiol ar gyfer modiwlau israddedig*: Sylfeini Mathemateg, Dadansoddiad Go Iawn.

Cyflwynir y sgwrs yn Saesneg

***18 Nov 2021: “Eigenvectors, Eigenvalues and the Cayley-Hamilton theorem” by Adrian Wells, FMSP Wales***

Eigen is a German word with several meanings, more usually considered to be particular or peculiar (which does make it interesting as a mathematical concept). In short, an eigenvector is a vector which is mapped by some operation onto a multiple of itself (this multiple is described as the related eigenvalue). Typically, the operation utilised is multiplication by a square matrix, since these can be used to represent transformations in 2 and 3 dimensions. Study and evaluation of eigenvalues and vectors gives rise to a characteristic equation directly linked to the matrix being used. This equation gives direct rise to the Cayley-Hamilton theorem: Any matrix will satisfy its own characteristic equation, perhaps a little simplified but it then allows an alternative approach to evaluating powers of the matrix. Not too much of a problem with 2x2 matrices but progressively more challenging as the square matrix becomes bigger in dimension.

*Prior knowledge required*: It is anticipated that not all participants will have studied further maths but a brief introduction to 2x2 matrix algebra: determinants, multiplication and transformations (think GCSE, reflection, rotation and enlargement) would enable you to gain more from the session. A brief work through these topics can be found on the Khan Academy website <https://www.khanacademy.org/math/algebra-home/alg-matrices> , if you are able to access it the section on matrices and transformation to be found on Integral is particularly good.

<https://2017.integralmaths.org/course/view.php?id=14> . There are, of course, several other articles and videos to be found on the web.

*Useful for undergraduate modules*: Linear Algebra, Vector Spaces, Methods of Algebra and Calculus.

The talk will be delivered in English.

***18 Tach 2021: “Fectorau Eigen -*** ***gwerthoedd Eigen a theorem Cayley-Hamilton” gan Adrian Wells, RhGMB Cymru***

Gair Almaeneg yw Eigen gyda sawl ystyr, a ystyrir fel arfer yn arbennig neu'n rhyfedd (sy'n ei wneud yn ddiddorol fel cysyniad mathemategol). Yn fyr, fector yw fector eigen sy'n cael ei fapio gan ryw weithrediad ar luosrif ohono'i hun (disgrifir y lluosrif hwn fel y gwerth eigen cysylltiedig). Yn nodweddiadol, y weithred a ddefnyddir yw lluosi â matrics sgwâr, gan y gellir defnyddio'r rhain i gynrychioli trawsnewidiadau mewn dimensiynau 2 a 3. Mae astudio a gwerthuso gwerthoedd fectorau eigen yn arwain at hafaliad nodweddiadol sy'n uniongyrchol gysylltiedig â'r matrics sy'n cael ei ddefnyddio. Mae'r hafaliad hwn yn arwain yn uniongyrchol at theorem Cayley-Hamilton: Bydd unrhyw fatrics yn bodloni ei hafaliad nodweddiadol ei hun, wedi'i symleiddio ychydig efallai ond yna mae'n caniatáu dull amgen o werthuso pwerau'r matrics. Dim gormod o broblem gyda matricsau 2x2 ond yn fwy heriol yn raddol wrth i'r matrics sgwâr ddod yn fwy o ran dimensiwn.

*Gwybodaeth flaenorol sy'n ofynnol*: Rhagwelir na fydd pob cyfranogwr wedi astudio mathemateg bellach ond byddai cyflwyniad byr i algebra matrics 2x2: penderfynyddion, lluosi a thrawsnewidiadau (TGAU, myfyrio, cylchdroi ac ehangu) yn eich galluogi i ennill mwy o'r sesiwn. Gellir gweld gwaith byr trwy'r pynciau hyn ar wefan Academi Khan https://www.khanacademy.org/math/algebra-home/alg-matrices, os gallwch gyrchu'r adran ar fatricsau a thrawsnewid sydd i'w chael ar Integral mae’n arbennig o dda https://2017.integralmaths.org/course/view.php?id=14. Mae yna, wrth gwrs, sawl erthygl a fideo arall i'w cael ar y we.

*Yn ddefnyddiol ar gyfer modiwlau israddedig*: Algebra Llinol, Gofodau Fector, Dulliau Algebra a Chalcwlws.

Cyflwynir y sgwrs yn Saesneg.

***2 Dec 2021: “The Complex Plane” by Dr Mathew Pugh, Cardiff University***

In this session we will look at where complex numbers came from and why they're useful. Through the course of the sessions we will visit the cubic formula, the Fundamental Theorem of Algebra and the beautiful but mysterious Mandelbrot set.

*New concepts*: Imaginary and complex numbers, complex variables, complex functions.

*Useful for undergraduate modules*: Foundations of Mathematics, Complex Analysis.

The talk will be delivered bilingually.

***2 Rhagfyr 2021: “Y Plân Cymhlyg” gan Dr Mathew Pugh, Prifysgol Caerdydd***

Yn y sesiwn yma edrychwn ar ddyfodiad rhifau cymhlyg a pham eu bod yn ddefnyddiol. Wrth fynd trwy'r sesiwn mi fyddem ni'n cyfarfod yr hafaliad ciwbig, Theorem Sylfaenol Algebra, a'r set Mandelbrot prydferth a rhyfeddol.

*Cysyniadau newydd*: Rhifau dychmygol a chymhlyg, newidynnau cymhlyg, ffwythiannau cymhlyg.

*Yn ddefnyddiol ar gyfer modiwlau israddedig*: Sylfeini Mathemateg, Dadansoddiad Cymhlyg.

Cyflwynir y sgwrs yn ddwyieithog.

***16 Dec 2021: “Mathematics of Vibrating plates: Chladni figures and Tacoma Bridge” by Professor Vitaly Moroz, Swansea University.***

The concept of partial derivatives emerges in the study of spatial objects. It is introduced at the 2nd year of the undergraduate Maths degree and leads to the study of partial differential equations at the 3rd year. Examples include biharmonic equations which model vibrating plates or suspension bridges, depending on the boundary conditions imposed. These equations are incredibly difficult and can not be solved exactly but simple approximations were invented by mathematicians and could be programmed into computers. Remarkably, these approximations work extremely well for Chladni plates and not so well for suspension bridges. Parts of this presentation are based on the discoveries made in the final year dissertation by an undergraduate Swansea Maths student.

*New concepts*: partial derivatives, partial differential equations, biharmonic equations, boundary conditions, numerical approximations.

*Useful for undergraduate modules*: Multi-variable calculus, Differential Equations.

The talk will be delivered in English.

***16 Rhagfyr 2021: “Mathemateg platiau dirgrynol; Ffigurau Chladni a Phont Tacoma” gan Yr Athro Vitaly Moroz, Prifysgol Abertawe***

Daw'r cysyniad o ddeilliadau rhannol i'r amlwg wrth astudio gwrthrychau gofodol. Fe'i cyflwynir yn 2il flwyddyn gradd Mathemateg israddedig ac mae'n arwain at astudio hafaliadau differol rhannol yn y 3edd flwyddyn. Ymhlith yr enghreifftiau mae hafaliadau biharmonig sy'n modelu platiau sy'n dirgrynu neu bontydd crog, yn dibynnu ar yr amodau terfyn a osodir. Mae'r hafaliadau hyn yn anhygoel o anodd ac ni ellir eu datrys yn llwyr ond dyfeisiwyd brasamcanion syml gan fathemategwyr a gellid eu rhaglennu i mewn i gyfrifiaduron. Yn rhyfeddol, mae'r brasamcanion hyn yn gweithio'n dda iawn ar gyfer platiau Chladni ac nid cystal ar gyfer pontydd crog. Mae rhannau o'r cyflwyniad hwn yn seiliedig ar y darganfyddiadau a wnaed yn nhraethawd y flwyddyn olaf gan fyfyriwr israddedig Mathemateg Abertawe.

*Cysyniadau newydd*: deilliadau rhannol, hafaliadau differol rhannol, hafaliadau biharmonig, amodau ffiniau, brasamcanion rhifiadol.

*Yn ddefnyddiol ar gyfer modiwlau israddedig*: Calcwlws aml-newidiol, Hafaliadau Differol.

Cyflwynir y sgwrs yn Saesneg.

***20 Jan 2022: “Zombies” by Dr Vicki Brown, University of South Wales.***

In this talk, students will meet the famous 'SIR" epidemic model. This set of differential equations assume that the population is split into three groups - susceptible, infected and recovered, and looks at the movement between the different groups. The key concepts discussed will be methods for solving and analysing systems of differential equations, and interpreting those results in a real world setting.

*Useful for undergraduate modules:* This model is usually met in Mathematical Biology modules at university, but a lot of the concepts are first introduced in first and second year calculus modules.

The talk will be delivered in English.

***20 Ionawr 2022: “Zombies” gan Dr Vicki Brown, Prifysgol De Cymru***

Yn y sgwrs hon, bydd myfyrwyr yn cwrdd â'r model epidemig enwog 'SIR ". Mae'r set hon o hafaliadau differol yn tybio bod y boblogaeth wedi'i rhannu'n dri grŵp - yn dueddol o gael ei heintio, wedi’i heintio ac wedi gwella, ac yn edrych ar y symudiad rhwng y gwahanol grwpiau. Y cysyniadau allweddol a drafodir bydd dulliau o ddatrys a dadansoddi systemau hafaliadau differol, a dehongli'r canlyniadau hynny mewn lleoliad byd go iawn.

*Yn ddefnyddiol ar gyfer modiwlau israddedig*: Mae'r model hwn fel arfer yn cael ei weld mewn modiwlau Bioleg Fathemategol yn y brifysgol, ond mae llawer o'r cysyniadau'n cael eu cyflwyno gyntaf mewn modiwlau calcwlws blwyddyn gyntaf ac ail
Cyflwynir y sgwrs yn Saesneg.

***3rd Feb 2022: “Maths & Art” by Dr Sofya Lyakhova, FMSP Wales, Swansea University.***

Since Eugene Wigner, a Physics Nobel laureate,  proposed that the usefulness of mathematics in science is “something bordering on the mysterious and there is no rational explanation for it”, connections between mathematics and other areas of human activities have been actively explored by mathematicians and scientists but also by artists, philosophers and educators. The phenomenon known as the “unreasonable effectiveness of mathematics in science” or simply Wigner’s puzzlement, has recently been extended to include art. According to some, not only the effectiveness of mathematics in science but also the attractiveness of mathematics to artists, is unreasonable. In my talk I will explore contemporary artists’ use of mathematics, the reasons behind it and its influence on mathematics.

*New concepts*: Image, perception, recursion, conformal maps, Droste effect.

*Useful for undergraduate modules*: Foundations of mathematics, mathematics education, computer science.

The talk will be delivered in English.

***3 Chwefror Feb 2022: “Mathemateg a Chelf” gan Dr Sofya Lyakhova, RhGMB Cymru, Prifysgol Abertawe***

Ers i Eugene Wigner, enillydd gwobr Nobel Ffiseg, gynnig bod defnyddioldeb mathemateg mewn gwyddoniaeth yn “rhywbeth sy’n ymylu ar y dirgel ac nad oes esboniad rhesymegol amdano”, mae cysylltiadau rhwng mathemateg a meysydd eraill o weithgareddau dynol wedi cael eu harchwilio gan fathemategwyr a gwyddonwyr ond hefyd gan artistiaid, athronwyr ac addysgwyr. Yn ddiweddar, estynnwyd y ffenomen a elwir yn “effeithiolrwydd afresymol mathemateg mewn gwyddoniaeth” neu yn syml rhyfeddod Wigner, i gynnwys celf. Yn ôl rhai, mae nid yn unig effeithiolrwydd mathemateg mewn gwyddoniaeth ond hefyd atyniad mathemateg i artistiaid, yn afresymol. Yn fy sgwrs byddaf yn archwilio defnydd artistiaid cyfoes o fathemateg, y rhesymau y tu ôl iddo a’i ddylanwad ar fathemateg.

*Cysyniadau newydd:* Delwedd, canfyddiad, dychweliad, mapiau cydffurfiol, effaith Droste.

*Yn ddefnyddiol ar gyfer modiwlau israddedig*: Sylfeini mathemateg, addysg fathemateg, gwyddoniaeth gyfrifiadurol.

Cyflwynir y sgwrs yn Saesneg.

***17 Feb 2022: “Number Theory and Cryptography” by Professor Vic Grout, Glyndwr University***

A few hundred years ago, a mathematician was playing around with prime numbers and modulo arithmetic and proved an interesting but small result.  Now, almost three centuries later, that theorem is the foundation of most modern-day computer security systems! How did that happen? In this session, we’ll quickly look at the requirements of today’s Internet security (confidentiality, integrity, authenticity, etc.) and how some simple properties of prime numbers and suchlike can give us what we need.  We’ll start with simple ‘parity’ and ‘frame’ checks, through one-off ‘key exchange’, then demonstrate a complete ‘RSA cryptosystem’ example. Finally, we’ll look at how the same basic processes can be tweaked to solve different issues.

*Useful for undergraduate modules*:Algorithms, Linear Algebra, Computer Science.

The talk will be delivered in English.

***17 Chwefror 2022: “Theori Rhif a Chryptograffeg” gan Yr Athro Vic Grout, Prifysgol Glyndŵr***

Ychydig gannoedd o flynyddoedd yn ôl, roedd mathemategydd yn chwarae o gwmpas gyda rhifau cysefin a rhifyddeg modulo a phrofodd ganlyniad diddorol ond bychan. Nawr, bron i dair canrif yn ddiweddarach, y theorem honno yw sylfaen y rhan fwyaf o systemau diogelwch cyfrifiadurol modern! Sut ddigwyddodd hynny? Yn y sesiwn hon, byddwn yn edrych yn gyflym ar ofynion diogelwch Rhyngrwyd heddiw (cyfrinachedd, gonestrwydd, dilysrwydd, ac ati) a sut y gall rhai priodweddau syml rhifau cysefin a thebyg roi'r hyn sydd ei angen arnom. Byddwn yn dechrau gyda gwiriadau syml ‘cydraddoldeb’ a ‘ffrâm’, trwy ‘newid allweddol’ unigryw, yna’n dangos enghraifft gyflawn o ‘cryptosystem RSA’. Yn olaf, byddwn yn edrych ar sut y gellir newid yr un prosesau sylfaenol i ddatrys gwahanol faterion.

*Yn ddefnyddiol ar gyfer modiwlau israddedig:* Algorithmau, Algebra Llinol, Cyfrifiadureg.

Cyflwynir y sgwrs yn Saesneg.

***3rd March 2022: “The Geometry of Curved Spaces” by Dr Edwin Beggs, Swansea University.***

The world is round, and therefore curved. In other words, the sum of the internal angles of a triangle may not be 180 degrees. For centuries map makers have dealt with the consequences of this in trying to produce flat maps of the world. We have spherical geometry for the surface of the Earth and also hyperbolic geometry, in many respects the opposite sort of curved geometry. In 1854 the German mathematician Riemann worked out the rules for general curved geometry, and in 1915 this was used by Einstein to formulate his general theory of relativity. This continues to be our best theory of gravity, and has recently received huge observational verification with gravitational waves and the imaging of accretion disks around black holes in the centre of galaxies.

*New concepts*: Curvature, geodesics, stereographic projection, Einstein's general relativity.

*Useful for undergraduate modules*: geometry, physics and gravity, astronomy, geography.

The talk will be delivered in English.

***3 Mawrth 2022: “Geometreg Mannau Crwm” gan Dr Edwin Beggs, Prifysgol Abertawe***

Mae'r byd yn grwn, ac felly'n grwm. Mewn geiriau eraill, efallai na fydd swm onglau mewnol triongl yn 180 gradd. Am ganrifoedd mae gwneuthurwyr mapiau wedi delio â chanlyniadau hyn wrth geisio cynhyrchu mapiau gwastad o'r byd. Mae gennym geometreg sfferig ar gyfer wyneb y Ddaear a hefyd geometreg hyperbolig, ar lawer ystyr y math arall o geometreg grom. Ym 1854, gweithiodd mathemategydd yr Almaen Riemann y rheolau ar gyfer geometreg grom gyffredinol, ac ym 1915 defnyddiwyd hyn gan Einstein i lunio ei theori gyffredinol perthnasedd. Dyma yw ein theori orau o ddisgyrchiant o hyd, ac yn ddiweddar mae wedi derbyn sylw enfawr gyda thonnau disgyrchiant a delweddu disgiau cronni o amgylch tyllau du yng nghanol galaethau.

*Cysyniadau newydd*: Crymedd, geodeg, tafluniad stereograffig, perthnasedd cyffredinol Einstein.

*Yn ddefnyddiol ar gyfer modiwlau israddedig*: geometreg, ffiseg a disgyrchiant, seryddiaeth, daearyddiaeth.

Cyflwynir y sgwrs yn Saesneg.

***17 March 2022: “Mathemateg gyda Swigod, Mathematics with Bubbles” by Dr Tudur Davies, Aberystwyth University.***

Have you ever thought why a bubble is spherical? In this activity, we will answer this question mathematically, before going on to explore how we can use the structure of bubbles to solve real world problems! We will utilise the geometrical rules that soap bubbles satisfy to solve problems in which a minimal surface or length is sought.

*New concepts:* The exercises involved in the activity will cover topics in geometry and calculus, such as trigonometry, determining limits of functions and differentiation.

*Useful for undergraduate modules*: calculus.

The talk will be delivered bilingually.

***17 Mawrth 2022: “Mathemateg gyda Swigod” gan Dr Tudur Davies, Prifysgol Aberystwyth***

Ydych chi erioed wedi ystyried pam fod swigen â siâp sffêr? Yn y gweithgaredd hwn, byddwn yn ateb y cwestiwn yma’n fathemategol, cyn mynd ymlaen i archwilio sut gallwn ddefnyddio strwythur swigod i ddatrys problemau yn y byd go iawn! Byddwn yn defnyddio’r rheolau geometreg y mae swigod yn eu bodloni er mwyn datrys problemau lle rydym angen canfod arwynebedd neu hyd lleiaf posib. Bydd yr ymarferion yn cynnwys pynciau mewn geometreg a chalcwlws, er enghraifft trigonometreg, terfannau o ffwythiannau yn ogystal â differu.

***31 March 2022: “A mathematical meditation on circles” by Professor Jeffrey Giansiracusa, Durham University.***

In this talk we'll take a look at the history, symbolism and mathematics of the humble circle, one of the most fundamental and basic figures in all of mathematics. Despite its simple appearance, there is an abundance of fascinating ideas shaped by the circle, from the ancient Greeks, up to modern day software engineering and some of the most abstract developments in mathematical research.

*New concepts*: knot, conic sections, Mobius strip, topoesamerase and mathematics of DNA.

*Useful for undergraduate modules:* Relevant to various first year modules on Algebra and Geometry.

The talk will be delivered in English.

***31 Mawrth 2022: “Myfyrdod mathemategol ar gylchoedd” gan Yr Athro Jeffrey Giansiracusa, Prifysgol Durham***

Yn y sgwrs hon, byddwn yn edrych ar hanes, symbolaeth a mathemateg y cylch gostyngedig, un o'r ffigurau mwyaf sylfaenol a sylfaenol ym mhob rhan o fathemateg. Er gwaethaf ei ymddangosiad syml, mae digonedd o syniadau cyfareddol wedi'u siapio gan y cylch, o'r hen Roegiaid, hyd at beirianneg meddalwedd fodern a rhai o'r datblygiadau mwyaf haniaethol mewn ymchwil fathemategol.

*Cysyniadau newydd*: cwlwm, adrannau conig, stribed Mobius, topoesamerase a mathemateg DNA.

*Yn ddefnyddiol ar gyfer modiwlau israddedig*: Yn berthnasol i amrywiol fodiwlau blwyddyn gyntaf ar Algebra a Geometreg.

Cyflwynir y sgwrs yn Saesneg.

***Bonus talk, release date tbc: “Six degrees of separation - network science and graph theory” Dr Francis Hunt, FMSP Wales.***

Networks abound in modern life. We encounter social networks, road networks, distribution networks, computer networks. Questions of interest include how many degrees of separation are there between two people in a social network; who is the most "central" person in a network of friends; how robust is a computer or other network to disruption. Network Science grows out of the mathematical discipline of Graph Theory, which can be said to start in 1736 with Euler's work on the Königsberg Bridge problem. In this talk we will look at a sample of interesting and useful results from Network Science and Graph Theory. Prior knowledge of matrices would be useful for this talk.

*New concepts*: graph, network, edges, vertices.

*Useful for undergraduate modules:* Network Science; Graph Theory.

The talk will be delivered bilingually.

***Sgwrs ychwanegol, dyddiad rhyddhau i’w gadarnhau: “Chwe gradd o wahanu - gwyddoniaeth rhwydwaith a theori graff” gan Dr Francis Hunt, RhGMB Cymru***

Gwelir rhwydweithiau'n aml mewn bywyd modern. Rydym yn dod ar draws rhwydweithiau cymdeithasol, rhwydweithiau ffyrdd, rhwydweithiau dosbarthu, rhwydweithiau cyfrifiadurol. Mae cwestiynau diddorol yn cynnwys sawl gradd o wahanu sydd rhwng dau berson mewn rhwydwaith cymdeithasol; pwy yw'r person mwyaf "canolog" mewn rhwydwaith o ffrindiau; pa mor gadarn yw cyfrifiadur neu rwydwaith arall os gaiff ei darfu. Mae Gwyddoniaeth Rhwydwaith yn tyfu o ddisgyblaeth fathemategol Theori Graff, y gellir dweud iddo ddechrau ym 1736 gyda gwaith Euler ar broblem Pont Königsberg. Yn y sgwrs hon byddwn yn edrych ar sampl o ganlyniadau diddorol a defnyddiol o Wyddoniaeth Rhwydwaith a Theori Graff. Byddai gwybodaeth flaenorol am fatricsau yn ddefnyddiol ar gyfer y sgwrs hon.

*Cysyniadau newydd*: graff, rhwydwaith, ymylon, fertigau.

*Yn ddefnyddiol ar gyfer modiwlau israddedig*: Gwyddoniaeth Rhwydwaith; Theori Graff.

Cyflwynir y sgwrs yn ddwyieithog.

***Bonus talk, release date tbc: “Mathematical software” by Dr Randall Wright, Swansea University.***

Participants will be introduced to various software used by mathematicians, statisticians and scientists that mathematics undergraduate students are expected to encounter in their first year of study.

The talk will be delivered in English.

***Sgwrs ychwanegol, dyddiad rhyddhau i’w gadarnhau: “Meddalwedd fathemategol” gan Dr Randall Wright, Prifysgol Abertawe.***

Bydd cyfranogwyr yn cael eu cyflwyno i feddalwedd amrywiol a ddefnyddir gan fathemategwyr, ystadegwyr a gwyddonwyr y mae disgwyl i fyfyrwyr israddedig mathemateg ddod ar eu traws yn eu blwyddyn astudio gyntaf.

Cyflwynir y sgwrs yn Saesneg.

**Further Maths Support Programme Wales, Swansea University**

**Rhaglen Gymorth Mathemateg Bellach Cymru, Prifysgol Abertawe**

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Computational Foundry                      Y Ffowndri Gyfrifiadurol

College of Science                             Coleg Gwyddoniaeth

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