Product Design

Summer Taster Pack

The transition from Year 11 to Sixth Form

In A Level Product Design, you will start the year carrying out a range of mini-projects, building your creativity and practical abilities. You will also be attending 'theory' lessons where you will progress your knowledge and understanding of the subject from a GCSE to an A Level standard. NEA will begin in November and this will be your major design and make project and portfolio, which equates to 50% of your final grade. The exam being the other 50%. Throughout the A Level you will be:

- Expected to offer creative solutions to problems.
- Learn how to communicate ideas confidently using a range of design strategies such as 2D and 3D drawing, Isometric sketching, Orthographic technical drawing, CAD such as SketchUp (which is free to use on the web), cross-sections and close-ups, annotation to explain your work, and using clients to help decision make.
- Using inspiration from external sources such as designers and design houses to progress your design work.
- Carrying out 'Iterative Design', which includes testing, experimenting, updating, evaluating and gaining feedback from stakeholders throughout to gain successful final outcomes.
- Integrate Maths into your designing, planning and manufacturing.
- Carrying out a range of mini-projects to further progress your all-round design skills and learn new manufacturing techniques.
- Expected to have an outside interest in the subject of design, and partake in wider reading.
- Completing an NEA worth 50% of your final grade.
- Completing an examination worth 50% of your final grade.

To begin this course, you will need to bring an A4 ring binder to collate and organise all your project and theory work.

Useful websites: Edexcel A Level Design and Technology:

https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/design-technology-product-design-2017.html

Useful Textbooks: Maths in A Level Design and Technology:

https://www.amazon.co.uk/Essential-Maths-Skills-Design-Technology/dp/1510417060

Introduction to the Product Design summer tasks 2021:

The design industry operates on this constant desire to want to develop and improve the items we use on a day to day basis, whether this be redesigning the homes we live in, the furniture we relax on, or the technology that consumes our daily lives.

Task 1 – All About You

What is it that makes you want to pursue a design course, why are you interested in developing your design skills? This will help us understand you, your aspirations and how best to support you.

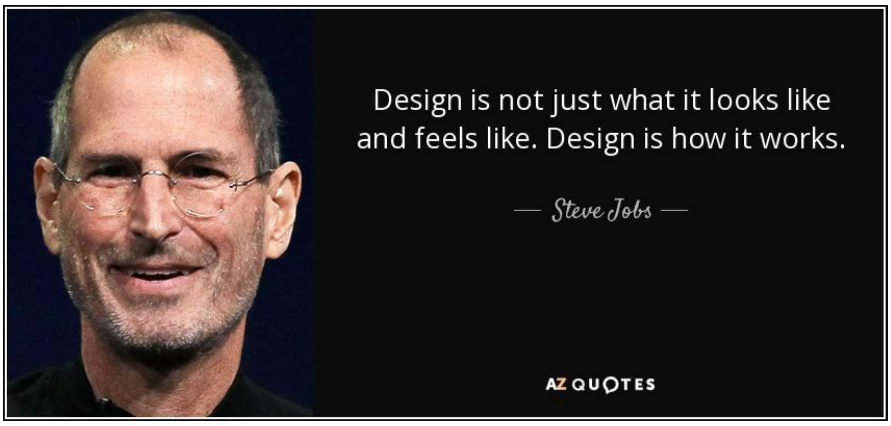
In the box below, write a short paragraph, no more than 300 words (no less than 200) explaining why you are opting to study Product Design at A Level.

Include what you believe to be your strengths and your areas you would like to work on over the course of the sixth form.

Task 2 – Inspirational Designers!

Research an Architect, designer or design firm that excites you!

What is it about their work that makes you feel inspired? In no more than 400 words introduce them, and clearly outline their key design principles. Include images you can discuss. What makes their style unique? Select one example of their work and analyse it from both a form and function perspective.



Task 3 – CAD - SketchUp

CAD = Computer aided design, love it or hate it, it's the way we design products in modern society. You may love using CAD and be very confident in this field, fantastic! Or, you may need a little bit more encouragement and practice. Design a chair in the style of the architect you researched in task 2. There are loads of YouTube help clips for anything you may struggle with. I have attached a tips sheet below.

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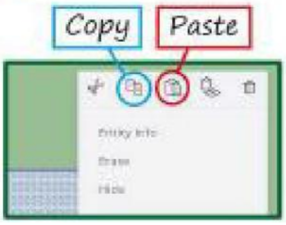

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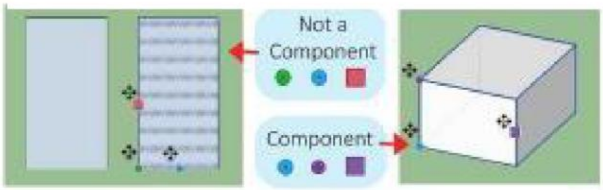

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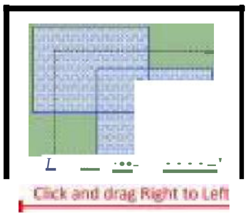

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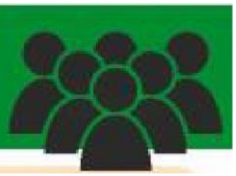

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VIEWS

How to look at your model from different angles.

You can get to your Sketchup views in 2 ways.

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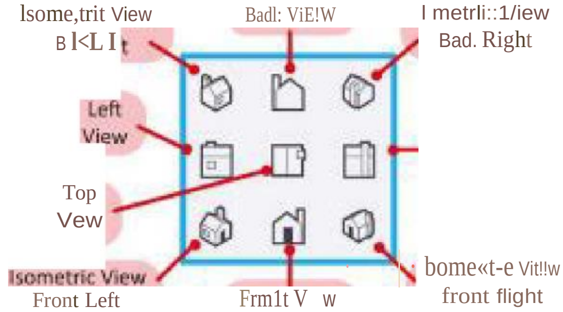


Task 4 – Upcycling!

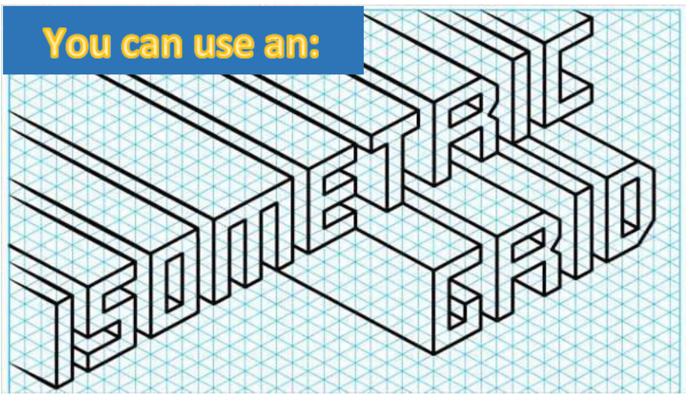
What is it? Why is this one of the hottest trends in modern design? Using nothing but old packaging or unused products from your home, and make a high-quality model of a Product.

This could be anything, a trinket box to a lamp, a car to a decorative ornament. Carry out some research first to gain some inspirations, have a look around your house, shed, garage to see what is unused and unwanted (check with parents first!) See the inspiration below.

Good Luck and Get Upcycling!

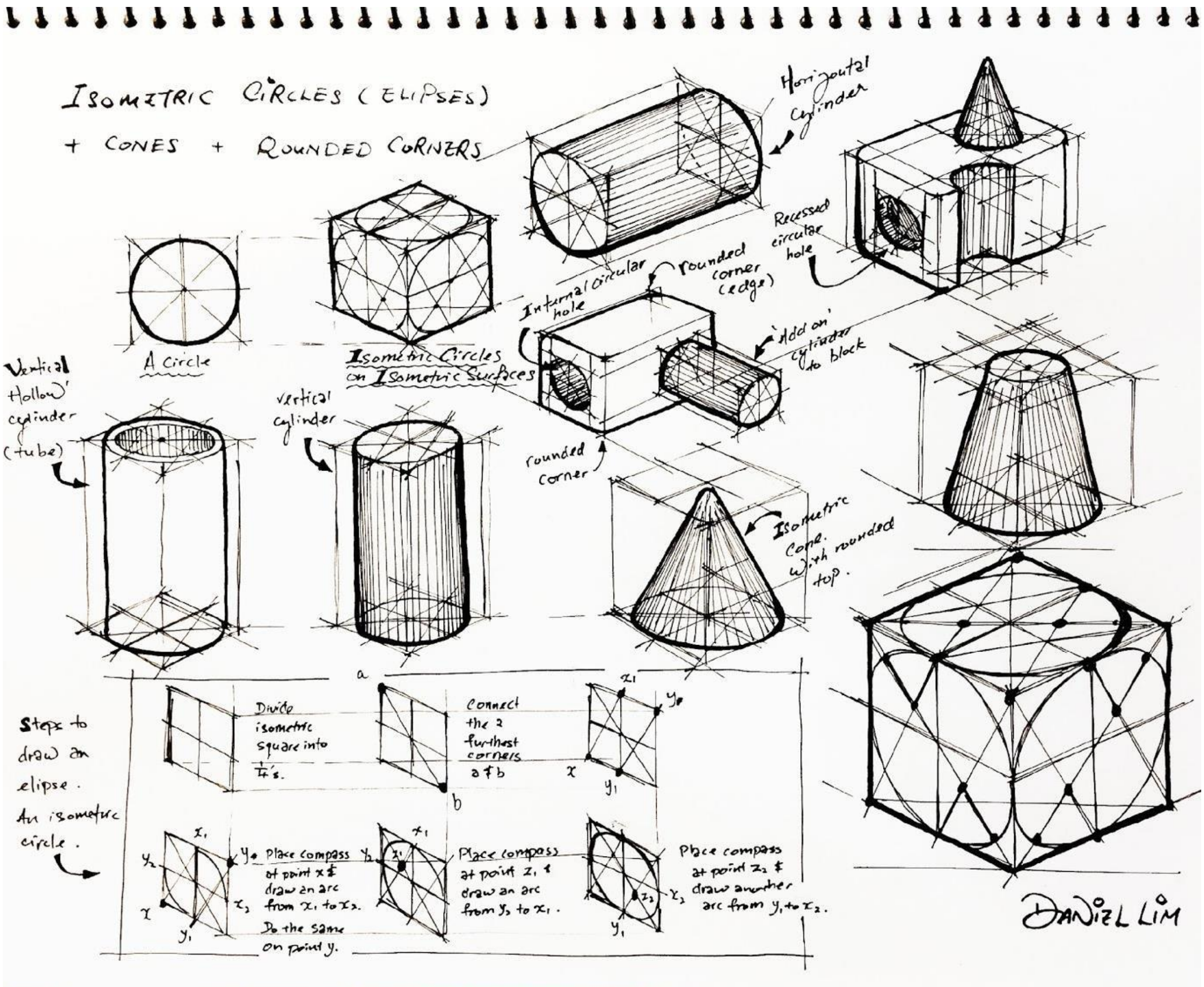
Task 5 – Isometric Sketching

Produce a high quality, hand drawn ISOMETRIC sketch of your upcycled product. Don't worry, this is something we work on at A Level, but let's see your skills!



There are plenty of options of isometric grid paper online, feel free to download one and use it, if it helps at this stage!

Below is a help sheet for the more difficult shapes. These use a method called 'crating', where a cuboid is drawn, and the more difficult shape is then drawn inside this, making the process easier. Have a go at this.



Mathematics in A Level Design and Technology

Have a look at the following Maths criteria we will be covering. Do you feel comfortable with these topics? Add ticks to the topics you are confident with and crosses to the ones you may struggle with.

Introduction

Mathematical skills are an essential part of AS and A Level Design and Technology.

In order to be able to develop their skills, knowledge and understanding in design and technology, students need to have been taught, and to have acquired competence in, the appropriate areas of mathematics relevant to design and technology, as indicated in the tables that follow.

The assessment of mathematical skills will include at least 15% level 2 or above for design and technology, in the context of the examinations.

The following tables illustrate where these mathematical skills may be developed and could be assessed.

Reference	Mathematical skills requirement	Potential applications
a	Confident use of number, percentages and percentiles	• Calculation of quantities of materials, costs and sizes
b	Use of ratios	• Scaling drawings
c	Calculation of surface areas and/or volumes	• Determining quantities of materials
d	Use of trigonometry	• Calculation of sides and angles as part of product design
e	Construction, use and/or analysis of graphs and charts	• Representation of data used to inform decisions and evaluation of outcomes • Presentation of market data, user preferences, outcomes and market research
f	Use of coordinates and geometry	• Use of datum points and geometry when setting out design drawings
g	Use of statistics and probability as a measure of likelihood	• Interpretation of statistical analyses to determine user needs and preferences • Use of data related to human scale and proportion to determine product scale and dimensions

On the next page, you will find each Maths topic broken down with an explanation of how to attempt calculations for each one.

Maths skillls for AS and A Level Design and Technology

Confident use of nun1ber, percentages and percentiles

lNu1nber

To convert fa-om one metric unit to armther, it is nece-Ssary to know the followingi:

!Length	Weight	Volume
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100 cm = 1 m	1000 g = 1 kg1	1000 mJ := 1 li re
lOOlJ mm = 1. m		1000 om^3 = 1 litre
lOOlJ m = 1 km		1000 /= 1. m3

You only n1eed bo be able to mul·oiply or divide b;y 101, 100 or 1000 in 1ordei- to be able to convert betv een mebic units.

- When conve1tingl from a sm aller n1JJlm ber to al lalrger lrn1m belr you mu.,t remember to diviide,.
- When conve .ingl from a bigger 111111!m1 b elr to, a s1mall er 111111111111b,er you must remlem ber to m111lEtCjplly-,.

Wh1en canying out some cornplex ealoulations, you may g1et an answei- on you - caloulator with lots of numbers, such as 125.3867

If tih1e answer was being used to measure 10u t a l1e1ni;rtih, i· wo u ld not be possible: to mark out the length to that level of aoouracy.

Certainly when measu1ing componen wi· ha micromet,er m· Vernier callipers, it is po:s:sible t,o meas.une to 2 decimal plaaes, e.g,. 26.67 mm.

We ·tiherefm-e rio u111,d numbem to a given number 1of decimal places,.

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(1.0648 = 0.06 correct to 2 decimal places	Round down because IJ..0648 is closer to 0.06 than to 0.07
6. .475 = 6.248 con-ect to 3 decimal places	If the ru1gure 1n the fourth dedmal place is 5 or more the111ound[up,

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$$5.7 \times 10^4$$

This pa1t is w1itten as a number b1etween 1. a1111d 10

This pa1t is written as a powe1- of 10

l nnm = 1 x 10^{-3} mm· uu:mo nn
l n,2 := 1 x 10^{6} mm^{2}
l n,2 := 1 x 10^{4} cm

Et is import:ant to be able to nnanipulate equations..

To solve dem;.i· y-relaibed rques ions, we **can** use the **follov ing** equation:

$$\text{' em1sillty} = \frac{\text{1rnass}}{\text{vol11111ne}}$$

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> **Worked exan1ple:**
>
> A 11ing has:a m,ags of 15 **g.**
>
> **Gold** has a density of 19.3 g/om^3•
>
> Calol.lllate the volume of goldi required to make the **ring.**
>
> U'"**ing denisity** = $\frac{\textbf{ma1ss}}{\textbf{volume}}$
>
> this formula ca11 be rea111rangedl to ,give **voll!llme** = $\frac{\textbf{mass}}{\textbf{denisity}}$
>
> $\frac{15}{19.3}$ = 0..777 g/om^3

IPerc:e1r11tagres and pen:enti Ies

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To ealculaibe percentage ehang1e, the following1equation ean be used:

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So, i·f the initial dlata set is 22 and the fiinal data :set is 40 , then the percentage dhange is:

$$\left(\frac{40-22}{22}\right) \text{x HICI} = \left(\frac{18}{22}\right) \text{X } 100 = 81..8\% \text{ (or \&2\%)}$$

Worked example:

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Th,e o!ld factory was: 8000 m^2 and the new faotof)I' is 11500 m^2,.

Callol.llate the percentage inorea.s,e in floor space.

$$\frac{U51JO - 8000}{801)0} \times 100 = 43.75\% \text{ (or 44\%)}$$

Worked example:

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Callol.llate he final weight of he casti111,g once it has be,en m,a,chinedl.

Method 1

$$8\% \text{ Of } 3.65 = \frac{8}{100} \times 3.65$$

$= 0.2.92$ g [he 8% 1red1..1otion is 0.2.9 g]

3.65 - 0,.292 = 3.358 kg [s:ubtract it to work out the final weii,ght]

Method 2

100% - 8% = 92% [the final vallue is 92.% of the miginal weight]

$$92.\% = \frac{92}{100} = 0.92$$ [0,.92 is tlh,e multiplier]

0.92. x 3,.65 = 3.358 kg [multiply the o,riginal weight by 0,.92]

Com pound peroenta g,e inoreases a re oft:,en us:edl by cornpanies to p,roj,ect:· uture oosts such as sitaff salaries m· maoe iials aos.ts,.

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2	£1.03,000r	1113,000 x L03 ·- 100,000 x 1,.03^2	£106,0'90
3	£1.05,0901	106,090 x l,.i)3, ·- 100,000 x 1,.03^3	£109,272,.70

Use of rc1t·os

atllos are u:gedl to oom pa re rqu an i ies. Tihe s m pies ifmTil olf a ra- io has a whol1e 11umber with no commo:nifactor"'r e.g. 1:3

atiios are often 1gi'lllen in the form *1*:n where *n* is a number.

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fm· example,. 5:16 = $\frac{5}{5} : \frac{16}{5}$

= 1.:3.·

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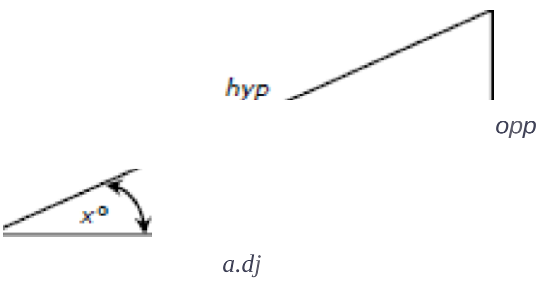
lit: is also important for oomp,an ies l:Jo be able to consider violumes when packaging items. lif a manu c11cl:Juring company is "'.hipping lap op:"'., they need to be able to convert:between units af 'i.i'iolumes wh1en th1ey package smaller bol<Jes into lang,e1· boxes·m lJransportalJion. Sometimes even shipp ingl rontainer v1olumes have to be con"'ideredl ito ensure ma:ximum use is made af · he available volume when moving1g1oods lfirom one country to another.

linsert: a dliag1c1m olf volume and surfooe a -ea formula for: oubeI cylindleri h1emis.phe11e a111d "'phere. ake sure o oove1· cir-cum lference andi area of a circle.

Use of trigonon1etry

Trig1onometry i:s.used extensively in the world of iteclrinolog1y and engineeiin1g,.lt: is. used to caloulate · he paths a111d movements af robot:s and automated guided veh ides (A!GVs) within footorieg. Pythagimas" theorem is. also used to calculate he lengrl:Jhof "".id:e..s. of a right-angled triangle, 01· fo1· checking that a righ -angled triangle has been marked ou corneotl"*l* with a 90° angle.

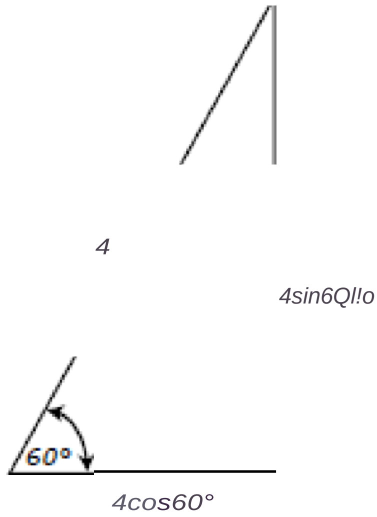
lihe longest sidle of a right-angled triangle is. k111orv n a,g. the lhyp,o;lltenl!J1se (hyp) and is always opposite the right: angle. The nemaining two sides are known as the op,posite (opp) a111d adjacent {adj)i as shown in **Figure** ..



Figlllr.e 1

Trig1onome ry can al:so be u:sed to calculate the anrgles, of joints. when manufacturiing pm d um. Fn ·ilire:s,e cases, we ne,ed to be able to app ly anrd use ·ilire s n,e and ,c:osi Iii e of a11g1lres.

En fiig11rel 2.r we c-an u:s,e thesinre and cosi11e of the angle to ealculaibe the u11known lengths af ·ilire triangle.



F"glll.lr,e 2

The length of the opposite can be calculated by 4 x sin&o^0 or 4-""in6o,^{0}

The length of the ardjaoe nt c-an be c-al ulated by 4 x co.s.6(f^1 or 4cos60°

En ·ilire revent that threlreng1h of the hypotenuse is u11k11own, the opposite and adj oen ea11 be ealeulated using the follrowing foimula e::

sin60^8 = QRQ. / hyp and oo·"'.6'0°,= adlii / hyp

Howeve,·.rthese nule .are only true for rig1ht-anrgledbianrgle .•

Whren the opposite side a11di the adjaoent side a ·-e involved:

Tan&0° := .Q!Q!1! / ardj

The acrronym ·0• HCAHTOA might help you to re mre mber these fornnulae:

Sin Opp Hyp Cos Adj "IP Tan Opp Adj

Constrl ction, use and/or anal·ysis of graphs and charts

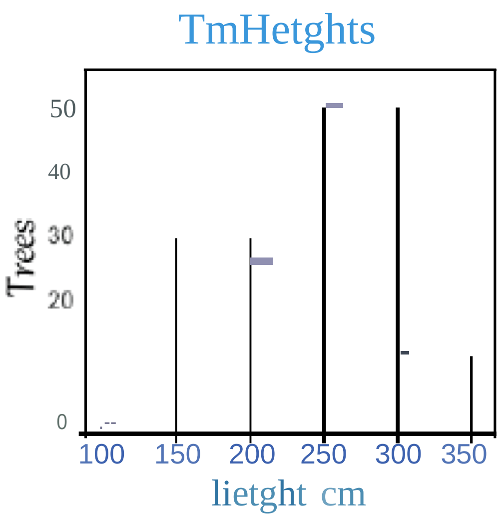
Graph""a11di charts a re a verv popular a11di effic,irent mnethod of reiPresenting a g -ea· deal of infro1mation and data,. Various cha :s anrd graphs a re used , suoh as bar oha rts pie cha, "' a11di hi:stog11c1nns..

User's needs . prefenenoe:s.and views are often canvassed as part:of the research p1-ooess, with the resu l· beiIlg1represented in a g □phireal · o rm.

Bar charts

Bar oharts: are lJlss:ed to 1-epresen1t gmup!!ed data, 1J1ss:mg rectangula - bars with va.-ying lengths, p1-opottD1t1al t,Q the 'llalues: !Jhat 1:Jhey represent. B.arn can hie plotted v,e tieally or horizontally, in 20 m· 3D. Wit'lll a v,atically plotted bar chart,. the vert:Dcal axis wi11be used ·ro repr-e e111lt a numerical value a111d the lrn,ars lJlcSed to ide111tify a .specific categoiry.

Fiig1111re 3 shows a ba,· chatt indi,cating the height of a num lmelf of trees at were planted on the samn,e day in a manag:ed forest. Thi,g:type of graph might mie us,ed to analyse: growl:Jln ra'tr.es: or bJ ide1111tify the: 111 umber- of trees b,efow a ae ain heig hit that l1lil i ght need to be:felled, tine:reby allowing the remainin,g b-ees ,greater aoaess to light an,d wat,e - and nu'li:rients i111:J'llle soil..



Figur.e 3

Pie cbairt.s

ie: c'lllarts are: ano!Jhelf pop!!ular me:!Jhod to re:presen1t data. They ca11easily hile ,ge11elfated in programns such as Microsoft:® ,excel.

Thew,ole oim1e represents the total n1J1mnber ,of items m·resp!lonses. Tine. siize of a sect,olf will be a pilf,opllrtion of the t,otal frequency.. Th,e angles at the (entre of the pie ohart must add up to 3600.

The an le fo - eadin sectm- can b,e fou n ol using the foll,owing formnlJl la:

$$\text{seotrnr alll gle} = \frac{\text{frequ,ency}}{\text{to'li:al frequency}} \times 360\ 0$$

T,able 1 shows the nunr1hilelf o,fow111ers of mnobil,e pho111e:s,and Fiigure. 4 slhow:s the same data ill !Jh,e fom, of a pi,e oha,t,.

lPl110111e	iPhone 6	iPhcrme: 7	Samsung1S.8	Samsm1g1 Galaxy eolg:e:	Nokria X1
lNt1111ber	38	26	15	13	8

Tab e I

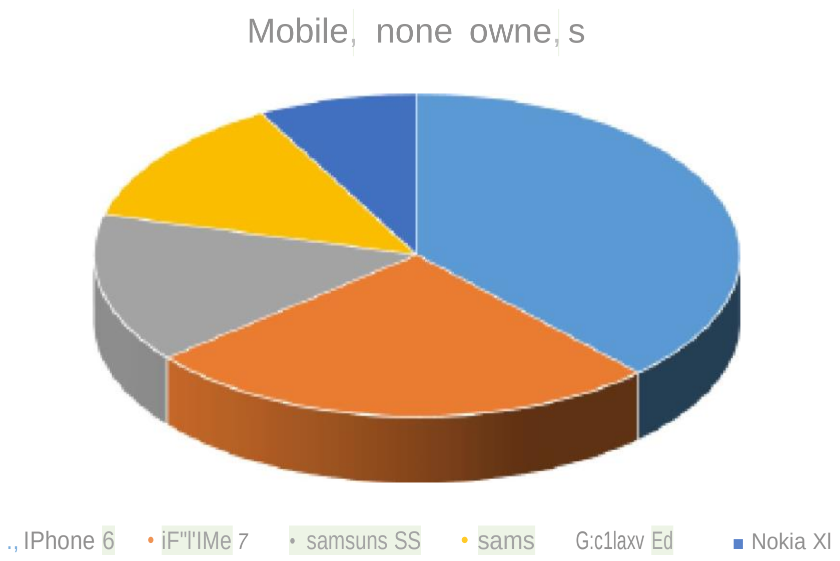


Figure 4

Total fr,eq1J1e111cy = 38 + 215 + 15 + 13 + 8 = 100

iPh,one 6 = $\frac{38}{1.00}$ x 3150,o = 136,.8°

Once all of l:Jli1e fr,eque11cies haveeen Gak1J1lat,ed yousncmld cheok that all ilie anrgles: add up t:o 3600.

Hilstogran s,

A nist,og!fa m ios used to represe1111t ao11'1tiuous data sυɔıdn as anrt'hmpi1onnebic data, e,g. ilrhe heights o:f studenrts illl yoJJr ali3'88. Cmrnti nuous ,dailrann ea ns there are no g1aps between thre bars.

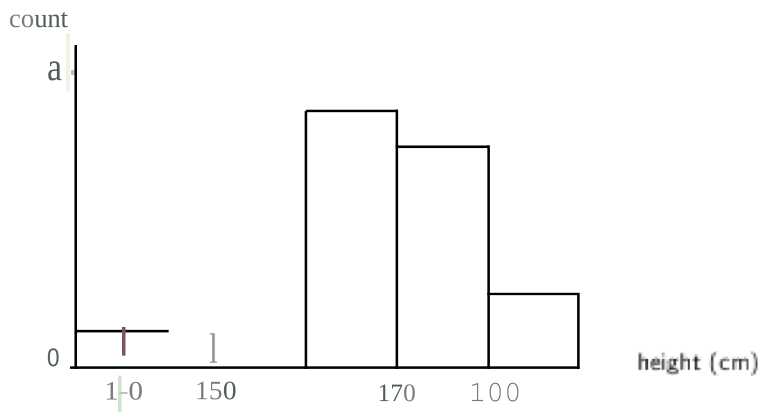


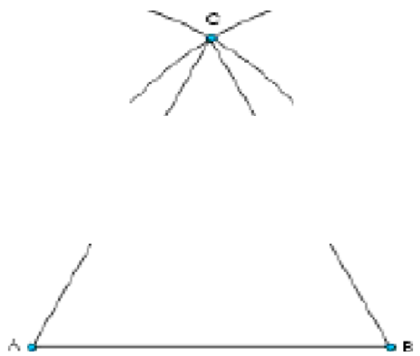
Fig11.1re :5

So ro tllpis;f)'www_siy=1.Jl:1,;oomJm:1tbs:f !!:-11[11-st::i'iiirti1:s:[l:ilap.:ici:1IT•B/"111!:l!l;ili'47646:1Jb,d!Jl254;:i 71i45:1,9 ,!;

se of coord-Hiltes and geon1etry

,A **dab.Jm** ref'e rellioe poirnt icSJlcSed when marking OlJlit rdu ring man1J1Jf:actu ri111g1proce.sses. **It** is a singlemi1111t from whioh all mneasmnernrooil:s anc: 1rakJern or f]Dints marked out,.
easuremenll:s woul,d be rgivern in mnnn, onn or mn dlependinrg 0111 1:Jlne saal,e anid si2!e of the o :eat beinrg marlred out.

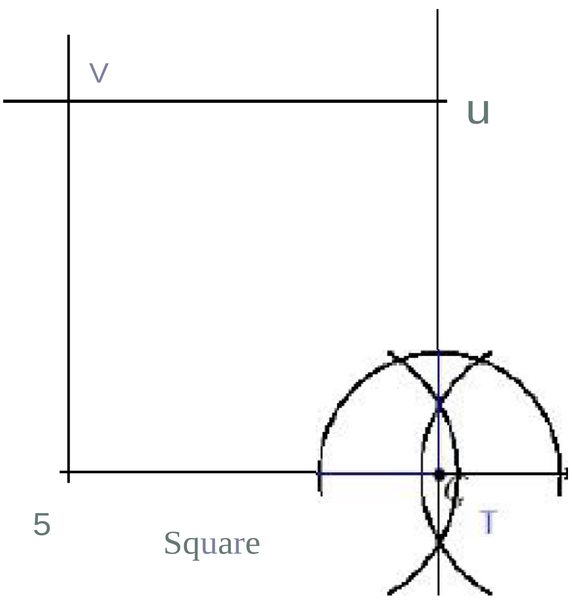
On some occasiionsir it is neces.sary to mark rout greom ebll"ic sh.api! es SIJeh as squ.ar,es and tttianrgles. Tlner,e are three rdiiffonent tyjp,es of triangle5ir but ilrhey can all be constrnctred wit:h a oom passr given the side lengths. Thre O(!iffipi!•ass i,s:.set::t,(!i tlhre lrenrg't:h requirred anid thie111lcSed to draw amarc. The sides of"lilne biangle can e drawrn w,em the arcs inter:s,eci:.



FiglllN!! *6*

m fig1111re 6,, 1:J'he triangle is an i:s'O!sceles 1:Jll"iarngle:: 1:Jlnis means !Jhat all lthree:sidle_s:arre e!Jlual in lerngrl:Jln. t also means that the thr,,e,e irnternal anrgles are equal at 600, there: being a total of l.aoOi111 anv bianrgle.

,A s.quare:rof t:he knowrnside length can also be oo:nstructed 1J1,Sing a compass, since: iit is po.s.siblre t,o cr,eat,e a go,oright-angl,e by biseoting a sbaigh line (w1nioh is essentially an rno;Oangle:).. This is shown i11Eiig1111re 1·.



FiglllN!! 7

Use of statistics and probability as a measure of likelihood

As part of any commercial manufacturing process, some form of quality control check will take place. Depending on the scale of production and what is being manufactured, there will be a set number of samples that are extracted for some form of checking, such as dimensional accuracy for example.

The sample for testing may well be taken at random if the product is, for example, a plastic injection-moulded pencil sharpener, where one in every thousand components might be tested. If it is an airplane, every part will be subjected to some form of testing.

Probability is the measure that an event will occur, such as a product not being made to a specific size or weight. The higher the probability, the more likely it is that the event will occur.

Send your completed tasks to Miss Corry

acorry@phs.cheshire.sch.uk

I can't wait to see them!

See you in September

😊