

IB Math Studies Key Vocab



“The brick walls are there for a reason. The brick walls are not there to keep us out. The brick walls are there to give us a chance to show how badly we want something. Because the brick walls are there to stop the people who don’t want it badly enough. They’re there to stop the other people.”

— [Randy Pausch](#), *The Last Lecture*

$a \times 10^k$, where $1 \leq a < 10$, $k \in \mathbb{Z}$

- Scientific notation!
- This will be a part of other questions.
- If the original number is less than 1, then k will be negative.
- On your calculator, use the EE button. Your calculator will use E as “ $10^{\underline{\quad}}$ ”

Arithmetic Sequence

- Common Difference (add or subtract to get next term)
- n is number of terms, d is common difference
- Remember, if you get a value, like $u_{20}=100$, that means you can substitute 20 in for n and 100 for u_n
- **USE YOUR FORMULA SHEET!!!**

Chi-Squared

- Knows the steps for the process
 - 1) Write null hypothesis (assume independence)
 - 2) Find expected
 - 3) Write rejection inequality $X^2 \text{ calc} > X^2 \text{ table}$
 - 4) Find X^2 value and decide whether to accept or reject
 - 5) State your final conclusion (either null or alternative hypothesis)
- **NOT THE SAME AS CORRELATION!!!** So, don't say it!

You can do it!!!



Compound interest

- Look for the word “compound” anywhere in the problem.
- Use the formula. Remember that k is the number of compoundings per year (ex. Monthly, $k=12$)
- Annual compounding also works for inflation or depreciation. Inflation of 5% would be $(1+5/100)^n$ or 1.05^n . Depreciation of 5% would be $(1-5/100)^n$ or $.95^n$
- **WATCH OUT FOR ROUNDING IN THE PROBLEM**

Continuous

- A type of variable that describes heights, weights, etc. “Something that needs to be rounded to a specified interval”
- Once it is rounded, it can be treated like a discrete variable (countable).

Correlation

- When a question asks about correlation, you are evaluating r (correlation coefficient). The closer r is to 1 or -1 the stronger the correlation. LinReg
- Make sure “Diagnostics On” has been set.
- Enter the values into 2 lists and do a linear regression to get the best fit line and r .
- Describe data using: “Strong” “Moderate” “Weak” and “Positive” or “Negative”



Cosine Rule/Sine Rule

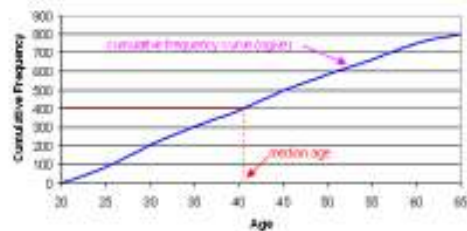
- Use this when you have a non-right triangle (otherwise use SOHCAHTOA)
- Label angles A, B, C and sides opposite a, b, c.
- Label known values. If you have a side and the angle opposite, you can use sine rule. Otherwise, cosine rule.
- Plug into correct formula. Enjoy!

Cumulative Frequency Graph

Age	Frequency	Age	Cumulative Frequency
		20 or less	0
21 - 25	86	25 or less	$0 + 86 = 86$
26 - 30	122	30 or less	$0 + 86 + 122 = 208$
31 - 35	96	35 or less	$0 + 86 + 122 + 96 = 304$
36 - 40	86	40 or less	390
41 - 45	109	45 or less	499
46 - 50	83	50 or less	582
51 - 55	75	55 or less	657
56 - 60	82	60 or less	739
61 - 65	47	65 or less	800

To create the cumulative frequency curve, we plot cumulative frequency against age. By convention, we plot the upper bounds so the first point we plot is (20, 0) and the second point is (25, 86) and so on. The resulting graph is shown below.

Cumulative frequency graph of employees' ages



The median is found by reading off the age at half of the total frequency, in this case at 400. From the graph we can see this is about 40.5 years. Use of graph paper may enable us to be more accurate.

Differentiate/Derivative

$$\frac{dy}{dx} \quad f', \quad \frac{dC}{dt}$$

- “Gradient of the tangent line”
- AKA rate of change of $f(x)$
- Know the power rule
- Rewrite fractions by dividing monomial denominators or using negative exponents first.

Discrete

- Variable that is countable
- Ex: The number of people that fell asleep in third period

The winner's edge is not in a gifted birth, a high IQ, or in talent. The winner's edge is all in the attitude, not aptitude. Attitude is the criterion for success.

- Denis Waitley

Exchange rate/Conversion

- Use the factor label method!
- Remember that the units for your final answer should be in the numerator.
- Read the question for rounding
- You need to know known metric conversions (kilo, centi, milli, etc)

Exponential Function

- Use your calculator!
- Know how to find horizontal asymptotes (use table and go big) and y-intercepts ($x=0$)
- Be careful to use () when substituting into a negative power: $y=2^{-.3x}$ Use: $y=2^{(-.3x)}$
- To solve something like when does $y=2^x-5$ equal 10....set up a system on your calculator. One equation is the exponential and the other is $y=$ ____ solution. Calculate intersection.



Geometric sequence

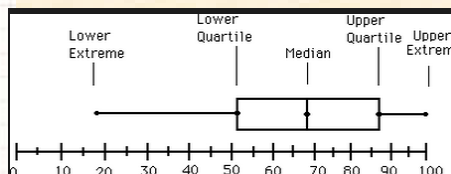
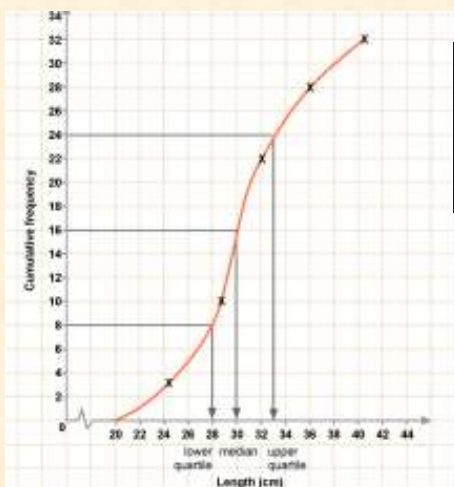
- Common Ratio (multiplied or divided by the same value)
- Find r by dividing the next term by the current term. TO CHECK USE MULTIPLICATION!!! r is a multiplier.
- Sums: Be careful when entering in your calculator.
- Geometric sequences are exponential.

Gradient

- Slope
- Change in y over change in x
- The derivative is the gradient of the tangent line
- 'Nuff said

Interquartile range

- Q3-Q1
- Q3 is 75th percentile, Q1 is 25th



*Also related...finding percentiles on a graph.
Can you find the 63rd percent length?

Linear Regression

- Enter coordinates into calculator
- X: L1 Y: L2
- Stat Calc Lin Reg. Gives you the equation of the best fit line.
- Interpolation (good): is using your line to predict within the data range. Extrapolation (bad) is using your line outside the range. It is not reliable.
- Also a formula on formula sheet

Logical Contradiction

- Last column in a truth table is all False

Null Hypothesis

- First step in chi-squared.
- Always assume that the data sets are independent.
- “Studying for a test and getting a good grade are independent.” (of course this will not be true)

Optimization

- Set $f' = 0$ and solve. Test values for maximum or minimum
- Or...go to your calculator and calculate the max or min of the original $f(x)$. If you do this method still show work for $f' = 0$
- Read question to see if they want x or $f(x)$ as their answer.

Percent error

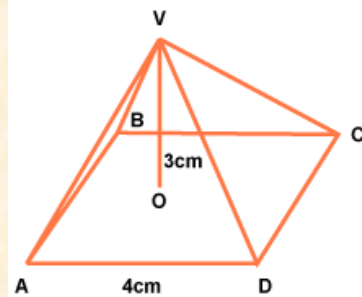
- Use the formula! Just make sure you divide by the exact (or original amount if you are doing percent change)

Probability

- Successful/Total Sample Space
- Simple independent probabilities are multiplied
- When “Given that” shows up, you have changed the sample space (made it smaller). Use formula $P(A | B)$. Go to your formula sheet or cover something on the Venn.

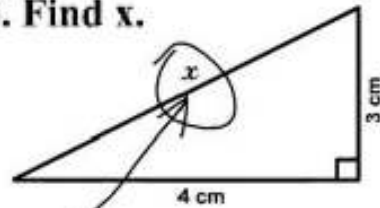
Pyramid Problems

- How do you find the length of the AC?
- What is the name of the angle made with an edge and the base?
- Describe an angle the face makes with the base. Is it the same as the edge and the base?
- Where are there right angles?



REDNECK SEAFOOD DINNER

3. Find x .



Here it is

Math teacher...



Why you never taught me this?

- $9 \times 1 = 9$
- $9 \times 2 = 18$
- $9 \times 3 = 27$
- $9 \times 4 = 36$
- $9 \times 5 = 45$
- $9 \times 6 = 54$
- $9 \times 7 = 63$
- $9 \times 8 = 72$
- $9 \times 9 = 81$
- $9 \times 10 = 90$



Standard Deviation

- The average that a set of numbers differs from the average.
- Find this “ σ ” on your calculator (1 var stats)

Subsets

$$a \subset b \quad a = \{1, 2, 4\} \quad b = \{1, 2, 3, 4, 5\}$$

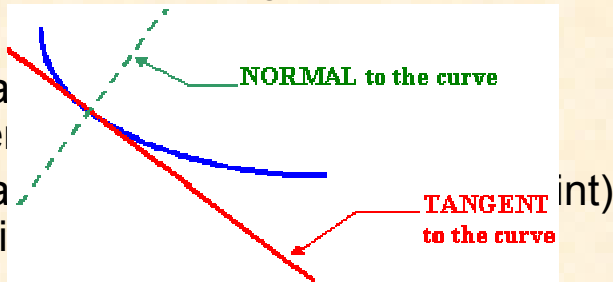
$$x \subseteq y \quad x = \{-1, 2, 100\} \quad y = \{\mathbb{Z}\}$$

- Every element in a subset is part of the universal set (or a larger set)

Tangents and Normals

Tangents

- As in “equation of a tangent line”
- Find f'
- Look for a point given
- Find equation of the tangent line and the gradient



Normals

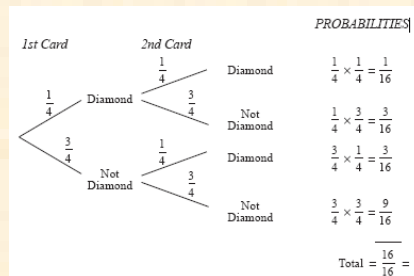
- Use same point, but opposite reciprocal slope. Find new equation. Graph to check for perpendicularity

Tautology

- If the final column in a truth table is ALL TRUE

Tree Diagram

- Used in probability
- Multiply through the tree
- Each branch section adds up to one
- All probs multiplied through add up to 1
- Read the question and use the tree to answer



Truth Table

- Know your combinations or where to find them on your formula sheet. Memorize conditional, inverse, converse, contrapositive.

p	q	$\neg p$	$\neg q$	$p \vee q$	$p \wedge q$	$p \Rightarrow q$	$p \Leftrightarrow q$
T	T	F	F	T	T	T	T
T	F	F	T	T	F	F	F
F	T	T	F	T	F	T	F
F	F	T	T	F	F	T	T

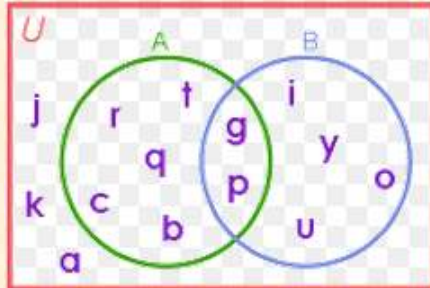
$p \Rightarrow q$ means if p then q e.g. If the sun is shining then I am happy

$q \Rightarrow p$ is the converse of $P \Rightarrow q$ e.g. if I am happy then the sun is shining

$\neg p \Rightarrow \neg q$ is the inverse of $P \Rightarrow q$ e.g. If the sun is not shining then I am not happy

$\neg q \Rightarrow \neg p$ is the contrapositive of $P \Rightarrow q$ e.g. If I am not happy then sun is not shining then

Universal Set



- All subsets must be members of this set
- You may want to review: \mathbb{Z} , \mathbb{Z}^+ , \mathbb{Z}^- , \mathbb{N} , \mathbb{N}^* , \mathbb{Q} , \mathbb{Q}'

They are often used as universal sets.

Validity

- A combination of factors that allow you to speak to the reliability and accuracy of your experiment. (Mainly used with your project)

TV Pitchmen (Venn Diagram)



Venn Diagram

Know how to shade or write symbolic notation for shading $P \cap Q$, $(P \cup Q)'$, $(P \cap Q \cap R)'$

Do you know what these symbols
or how they are used?

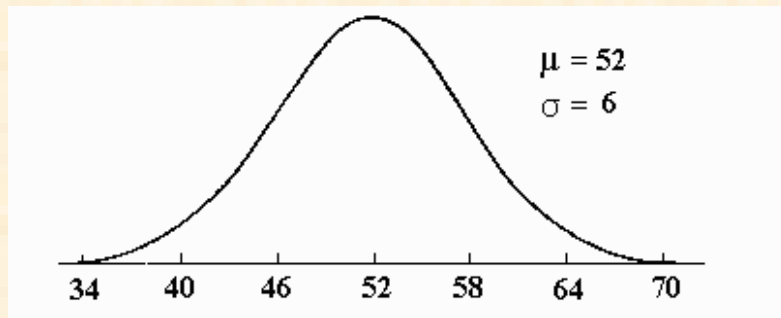
$$u_8 = 15 \quad u_n = u_1 + (n-1)d \quad u_n = u_1 r^{n-1}$$

$$\cup \quad \cap \quad \in \quad \subseteq \quad \subset$$

$$\sigma_x \quad \bar{X} \quad Q_1 \quad Q_3 \quad H_o$$

$$H_1 \quad \chi^2$$

Normal Curve



Inspirational Video

[Be a dog!](#)