

probability super teacher worksheets Reference

Probability Super Teacher Worksheets: The Ultimate Resource for Enhancing Math Skills

In the world of mathematics education, engaging resources are essential to help students grasp complex concepts effectively. **Probability super teacher worksheets** stand out as powerful tools designed to make learning probability both fun and educational. These worksheets serve as comprehensive materials that bolster understanding, foster critical thinking, and enhance problem-solving skills among students. Whether you're a teacher preparing lessons or a parent supporting homework, probability super teacher worksheets provide the structure and variety needed to teach probability concepts confidently and effectively.

Understanding the Importance of Probability in Math Education

Probability is a fundamental branch of mathematics that deals with the likelihood of events occurring. It is not only a core component of math curricula but also a vital real-world skill applicable in various fields such as statistics, finance, science, and everyday decision-making.

Why Teach Probability at an Early Age?

Probability concepts help students:

- Develop critical thinking and analytical skills
- Understand risk and uncertainty
- Make informed decisions based on data
- Apply mathematical reasoning to real-life situations

Introducing probability through engaging worksheets makes these abstract concepts accessible and relatable to young learners.

What Are Probability Super Teacher Worksheets?

Probability super teacher worksheets are specially designed educational resources aimed at teaching probability concepts across various grade levels. They are called 'super' because they often encompass a wide range of activities, exercises, and assessments tailored to different learning stages and skill levels.

Features of Probability Super Teacher Worksheets

- Comprehensive coverage of probability topics ? from basic concepts to advanced problems
- Variety of question formats, including multiple choice, fill-in-the-blanks, word problems, and puzzles
- Visual aids such as charts, diagrams, and probability trees
- Progressive difficulty levels to cater to beginners and advanced students
- Answer keys and detailed explanations for self-assessment and teacher use

These worksheets are designed to be flexible, making them suitable for classroom activities, homework assignments, or individual practice.

Key Topics Covered in Probability Super Teacher Worksheets

A well-rounded set of probability worksheets covers foundational concepts and gradually introduces more complex ideas. Here are the core topics typically included:

Basic Probability Concepts

- Understanding probability as a measure of likelihood
- Simple events and outcomes
- Probability notation and terminology
- Calculating probability as a ratio or fraction

Experimental and Theoretical Probability

- Conducting experiments to observe outcomes
- Comparing experimental and theoretical probabilities
- Using simulations to predict outcomes

Probability Calculations and Problems

- Calculating probabilities of single events
- Probability of combined events (e.g., "and," "or" scenarios)
- Conditional probability and dependent events
- Using probability formulas and trees

Applications and Real-Life Scenarios

- Games of chance like dice and card games
- Weather forecasting and natural phenomena
- Decision-making under uncertainty
- Statistics and data analysis basics

Benefits of Using Probability Super Teacher Worksheets

Implementing these worksheets in your teaching strategy offers numerous advantages:

Enhanced Student Engagement

- Interactive activities and puzzles captivate students' interest
- Variety of formats caters to different learning styles

Structured Learning Path

- Progressive difficulty helps students build confidence and mastery
- Clear explanations reinforce understanding

Assessment and Feedback

- Immediate feedback through answer keys
- Teachers can identify areas needing reinforcement

Flexibility and Convenience

- Printable and easy to distribute
- Suitable for individual, group, or class-wide activities

How to Effectively Use Probability Super Teacher Worksheets

Maximizing the benefits of these worksheets involves strategic planning and execution:

Integrate Worksheets into Lesson Plans

- Begin with foundational concepts before moving to complex problems
- Use worksheets as warm-up activities or review exercises
- Incorporate them into assessments to gauge understanding

Encourage Collaborative Learning

- Group students to solve problems together
- Facilitate discussions to deepen comprehension

Supplement Worksheets with Hands-On Activities

- Use physical objects like dice, coins, or cards for experiments
- Create real-world scenarios for students to analyze

Assess and Provide Feedback

- Review answers collectively to clarify misconceptions
- Assign additional exercises for areas needing improvement

Finding Quality Probability Super Teacher Worksheets

When searching for high-quality worksheets, consider the following sources:

Educational Websites and Platforms

- Teachers Pay Teachers
- Math-drills.com
- Khan Academy resources
- Super Teacher Worksheets (superteacherworksheets.com)

Criteria for Choosing the Best Worksheets

- Alignment with curriculum standards
- Variety of question types and difficulty levels
- Clear instructions and visual clarity
- Availability of answer keys and explanations

- Positive reviews and recommendations from educators

Customizing Worksheets for Your Classroom

- Modify problems to suit your students' interests
- Create your own problems based on real-life examples
- Combine worksheets to create comprehensive practice sessions

Additional Tips for Teaching Probability Effectively

To complement the use of probability super teacher worksheets, consider these teaching strategies:

Use Visual Aids and Models

- Probability trees and Venn diagrams
- Pie charts and bar graphs to visualize data

Incorporate Technology

- Simulation tools and apps for virtual experiments
- Interactive quizzes and online worksheets

Relate Probability to Everyday Life

- Discuss sports statistics, weather forecasts, or game strategies
- Encourage students to observe and analyze probability in their daily routines

Foster a Growth Mindset

- Encourage students to view mistakes as learning opportunities
- Celebrate progress and effort in mastering probability concepts

Conclusion

Probability super teacher worksheets are invaluable resources for making the learning of probability engaging, structured, and effective. They provide a versatile platform for teachers and parents to

introduce probability concepts, assess understanding, and reinforce skills through diverse activities and problem sets. By integrating these worksheets into your teaching repertoire, you can foster a deeper understanding of probability, develop critical thinking skills, and prepare students to apply mathematical reasoning confidently in real-world scenarios. Explore quality sources, customize activities to fit your students' needs, and combine worksheet practice with hands-on experiments for a well-rounded approach to teaching probability. Empower your students today with the engaging and comprehensive tools that probability super teacher worksheets offer!

Probability Super Teacher Worksheets have become a staple resource for educators aiming to enhance students' understanding of probability concepts. Designed to cater to a wide range of learning levels, these worksheets offer a comprehensive approach to teaching one of the most fundamental branches of mathematics. Whether used in classroom settings, homeschool environments, or as supplementary practice, they serve as valuable tools to develop students' skills in calculating, analyzing, and interpreting probability problems.

Introduction to Probability Super Teacher Worksheets

Probability Super Teacher Worksheets are an extensive collection of printable resources created to simplify the complex topics surrounding probability. They are crafted with the goal of making learning engaging, accessible, and effective for students across various age groups and proficiency levels. With a focus on clarity and progression, these worksheets aim to build foundational knowledge while gradually increasing complexity.

These worksheets often include a variety of question formats—multiple-choice, fill-in-the-blank, matching, and word problems—allowing teachers to tailor lessons to their students' needs. Their design emphasizes both conceptual understanding and practical application, which are essential for mastering probability.

Features and Content Breakdown

Range of Topics Covered

Probability Super Teacher Worksheets cover a broad spectrum of topics, including:

- Basic probability concepts (e.g., likelihood, outcomes, events)
- Calculating simple and compound probabilities
- Independent and dependent events
- Probability trees and diagrams
- Theoretical vs. experimental probability
- Using probability in real-world scenarios

- Combinations and permutations related to probability

This wide coverage ensures that students can progress from introductory concepts to more advanced applications within a structured framework.

Design and Usability

The worksheets are designed with clarity and student engagement in mind:

- Clear instructions and well-structured questions
- Visual aids such as charts, probability trees, and diagrams
- Varied difficulty levels to accommodate beginners and advanced learners
- Answer keys included for self-assessment and quick grading
- Printable format for easy distribution

These features make it straightforward for teachers to incorporate the worksheets into their lesson plans and for students to navigate the material confidently.

Advantages of Using Probability Super Teacher Worksheets

Comprehensive Coverage

- Offers a complete set of resources that can support entire units on probability
- Facilitates sequential learning, reinforcing concepts progressively
- Suitable for both introduction and review sessions

Flexibility and Customization

- Worksheets can be assigned as homework, classwork, or assessment tools
- Teachers can select specific topics or difficulty levels based on their curriculum
- Printable format allows for easy customization or modification if needed

Enhanced Student Engagement

- Mix of question types keeps students interested
- Visual aids help in understanding abstract concepts
- Real-world scenarios make probability relatable and meaningful

Time and Effort Saving

- Ready-made worksheets save teachers preparation time
- Includes answer keys for quick grading
- Encourages independent learning and self-assessment

Potential Challenges and Limitations

Limited Interactivity

- As static printables, they lack interactive or digital features that might enhance engagement
- May require supplementary activities or digital resources for a more dynamic experience

Possible Overgeneralization

- While comprehensive, some worksheets may not cover very advanced or niche topics in probability
- Teachers might need to create additional resources for specialized lessons

Dependence on Visual Aids

- Students who struggle with visual learning may find some worksheets less effective
- Supplementing with hands-on activities or manipulatives can be beneficial

How to Effectively Incorporate Probability Super Teacher Worksheets into Teaching

Assess Student Needs

Begin by evaluating students' current understanding of probability. Use diagnostic assessments to determine which worksheets are appropriate for practice or review, ensuring that students are neither overwhelmed nor under-challenged.

Structured Lesson Planning

Integrate worksheets into a broader lesson plan that includes discussions, demonstrations, and real-world applications. Use worksheets to reinforce concepts introduced during lectures or

interactive activities.

Group Work and Peer Learning

Encourage students to work in pairs or small groups on worksheets. This collaborative approach promotes discussion, clarifies misunderstandings, and deepens comprehension.

Progressive Difficulty

Start with basic probability questions, gradually increasing complexity as students become more confident. Use the worksheets' varied levels to scaffold learning effectively.

Assessment and Feedback

Utilize the answer keys for quick grading, but also provide personalized feedback. Consider using some worksheet questions as formative assessments to guide future instruction.

Examples of Popular Probability Super Teacher Worksheets

Basic Probability Worksheets

Designed for beginners, these worksheets introduce concepts such as outcomes, events, and simple probability calculations. They often include exercises like rolling dice, drawing cards, or flipping coins.

Advanced Probability Problems

Targeted at students ready for more challenging content, these worksheets include problems involving compound events, conditional probability, and probability trees.

Real-World Applications

These worksheets incorporate scenarios such as weather forecasting, sports statistics, and game strategies, making probability relevant and engaging for students.

Conclusion and Final Thoughts

Probability Super Teacher Worksheets are an invaluable resource for educators seeking to teach probability in an organized, effective, and engaging manner. Their extensive coverage, user-friendly design, and flexibility make them suitable for a variety of teaching contexts. While they may have some limitations regarding interactivity and depth for niche topics, their benefits far outweigh these

drawbacks for most classroom needs.

By thoughtfully integrating these worksheets into lessons, teachers can foster a deeper understanding of probability, develop critical thinking skills, and encourage students to see the relevance of probability in everyday life. As part of a well-rounded curriculum, Probability Super Teacher Worksheets can significantly enhance mathematical literacy and confidence among students.

Overall, they stand out as a reliable, versatile, and easy-to-use tool that supports both teaching and learning in the fascinating world of probability.

QuestionAnswer What are Probability Super Teacher Worksheets? Probability Super Teacher Worksheets are educational resources designed to help students understand and practice concepts related to probability through engaging exercises and activities. How can Probability Super Teacher Worksheets improve students' understanding of probability? They provide structured practice with real-life scenarios, visual aids, and step-by-step problems that enhance students' grasp of probability concepts and boost their problem-solving skills. Are Probability Super Teacher Worksheets suitable for all grade levels? Yes, they are often designed with varying difficulty levels, making them suitable for elementary, middle, and even high school students learning about probability. Where can I find the most popular Probability Super Teacher Worksheets? They are available on educational websites, teacher resource platforms, and in various teacher-authored collections that offer downloadable and printable worksheets. How can teachers incorporate Probability Super Teacher Worksheets into their lesson plans? Teachers can use these worksheets as classroom activities, homework assignments, or review tools to reinforce probability lessons and assess student understanding effectively.

Related keywords: probability worksheets, math teacher resources, probability exercises, teaching probability, math worksheets for teachers, probability practice sheets, classroom probability activities, math lesson plans, probability problem sets, educational probability worksheets

ib math probability

ib math probability

Understanding probability is a fundamental component of the IB Math curriculum, especially within the topics covered in the IB Mathematics Analysis and Approaches (AA) and Mathematics Applications and Interpretation (AI) courses. Probability allows students to analyze and predict the likelihood of various events, fostering critical thinking and quantitative reasoning skills. This

comprehensive guide aims to demystify IB Math Probability, providing an in-depth look at core concepts, key formulas, problem-solving techniques, and practical applications to excel in your IB assessments.

What is IB Math Probability?

Probability, in the context of IB Math, refers to the measure of the chance that a specific event will occur. It is expressed as a number between 0 and 1, where 0 indicates impossibility, and 1 indicates certainty. Understanding probability enables students to model real-world situations involving uncertainty, such as predicting outcomes in games, experiments, or data analysis.

Importance of Probability in IB Math

- Develops critical thinking and decision-making skills
- Enhances understanding of data and statistics
- Prepares students for higher-level mathematics and real-world applications
- Integral for topics like combinatorics, random variables, and statistical inference

Core Concepts of IB Math Probability

Basic Probability Principles

- Sample Space (S): The set of all possible outcomes of a random experiment.
- Event (E): A subset of the sample space, representing outcomes of interest.
- Probability of an Event (P(E)): The ratio of favorable outcomes to total outcomes, assuming equally likely outcomes.

Formula:

$$P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$$

Note: For non-uniform probability distributions, different methods are employed.

Types of Probability

- Theoretical Probability: Based on known possible outcomes.
- Experimental Probability: Derived from conducting experiments or simulations.
- Subjective Probability: Based on personal judgment or belief.

Fundamental Rules of Probability

Addition Rule

Used when calculating the probability that at least one of two events occurs.

- For mutually exclusive events (events that cannot happen simultaneously):

$$P(A \cup B) = P(A) + P(B)$$

- For non-mutually exclusive events:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Multiplication Rule

Used to find the probability that both events occur.

- For independent events (the outcome of one does not affect the other):

$$P(A \cap B) = P(A) \times P(B)$$

- For dependent events:

$$P(A \cap B) = P(A) \times P(B|A)$$

where $P(B|A)$ is the probability of B given A has occurred.

Conditional Probability and Independence

Conditional Probability

The probability of event B occurring given that event A has already occurred:

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

This concept is crucial when analyzing dependent events.

Independence of Events

Two events A and B are independent if:

$$P(A \cap B) = P(A) \times P(B)$$

If this condition is not met, the events are dependent.

Discrete Random Variables and Probability Distributions

Discrete Random Variables

Variables that take specific values, often counts or integers, with associated probabilities.

Probability Distributions

- Probability Mass Function (PMF): Assigns probabilities to each possible value.
- Expected Value (Mean): The average outcome of a random variable.

$$E(X) = \sum x \times P(X = x)$$

- Variance: Measures the spread of the distribution.

$$\text{Var}(X) = E[(X - E(X))^2]$$

Common Probability Distributions in IB Math

Binomial Distribution

Models the number of successes in a fixed number of independent trials with the same probability of success.

Conditions:

- Fixed number of trials (n)
- Two possible outcomes (success/failure)
- Independence between trials
- Constant probability of success (p)

Probability Mass Function:

$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$$

where k is the number of successes.

Geometric Distribution

Models the number of trials until the first success.

Probability:

$$P(X = k) = (1 - p)^{k-1} p$$

where $k \geq 1$.

Poisson Distribution

Models the number of events occurring in a fixed interval or space when events occur independently at a constant average rate λ .

Probability:

$$P(X = k) = \frac{\lambda^k e^{-\lambda}}{k!}$$

Solving IB Math Probability Problems

Step-by-Step Approach

- Define the problem: Clearly identify the experiment, sample space, and events.
- Determine the type of probability: Theoretical, experimental, or subjective.
- Identify relevant formulas: Use the appropriate probability rules and distributions.
- Calculate probabilities: Plug in values carefully, considering whether events are independent or dependent.
- Interpret results: Contextualize the probability, especially for real-world applications.

Practice Question Example

Question: A biased coin has a probability of heads $p = 0.6$. If the coin is flipped 10 times, what is the probability of getting exactly 6 heads?

Solution:

- Recognize the binomial distribution applies.
- Use the binomial PMF:

$$P(X = 6) = \binom{10}{6} (0.6)^6 (0.4)^4$$

- Calculate:

$$P(X=6) = 210 \times 0.0467 \times 0.0256 \approx 0.253$$

Answer: Approximately 25.3%.

Real-World Applications of IB Math Probability

Risk Assessment and Decision Making

Probability helps in evaluating risks in finance, insurance, and engineering.

Data Analysis and Statistics

Understanding variability and uncertainty in data sets.

Games and Sports

Calculating odds and strategies based on probabilistic models.

Science and Experiments

Modeling random phenomena in physics, biology, and social sciences.

Tips and Strategies for IB Math Probability Success

- Master basic probability rules before tackling complex problems.
- Practice a variety of problem types, including binomial, geometric, and Poisson distributions.
- Use diagrams, such as tree diagrams and Venn diagrams, to visualize problems.
- Understand the difference between independent and dependent events.
- Always check whether events are mutually exclusive before applying addition rules.

- Familiarize yourself with the formulas and when to apply them.
- Use calculator functions efficiently for binomial and Poisson probabilities.

Conclusion

Mastering IB Math probability is essential for excelling in the IB curriculum and beyond. By understanding core concepts, formulas, and problem-solving techniques, students can confidently analyze uncertain events and make informed decisions. Regular practice, combined with a solid grasp of the fundamental principles, will enhance your ability to tackle both theoretical and applied probability questions effectively. Whether preparing for exams or applying these concepts in real-world scenarios, a thorough understanding of IB Math probability equips students with valuable analytical skills for future academic and professional pursuits.

IB Math Probability is a fundamental component of the IB Mathematics curriculum, especially within the Analysis and Approaches (AA) and Applications and Interpretation (AI) courses. Probability concepts are not only crucial for understanding statistical reasoning but also serve as a bridge to more advanced topics in mathematics, data science, and real-world decision-making. For students preparing for the IB exams, mastering probability is essential for achieving high scores and developing a strong mathematical intuition. This comprehensive review explores the key aspects of IB Math Probability, its curriculum structure, core concepts, applications, and tips for effective learning.

Understanding the Role of Probability in IB Math

Probability in IB Math is designed to introduce students to the fundamentals of predicting and quantifying uncertainty. Unlike simple chance calculations, IB probability encompasses a wide range of topics, including combinatorics, probability distributions, conditional probability, and hypothesis testing. These areas collectively enable students to analyze complex scenarios, interpret data, and make informed decisions based on probabilistic reasoning.

The importance of probability extends beyond exams; it fosters critical thinking, supports statistical literacy, and prepares students for careers in fields such as economics, biology, engineering, and social sciences. The IB curriculum emphasizes both theoretical understanding and practical application, ensuring students can approach real-world problems with confidence.

Core Topics in IB Math Probability

1. Basic Probability Concepts

At the foundation of IB probability are fundamental ideas such as:

- Sample Space and Events: Defining all possible outcomes (sample space) and specific outcomes or collections thereof (events).
- Probability Axioms: Understanding that probabilities are numbers between 0 and 1, with the total probability of the sample space being 1.
- Calculating Probabilities: Using fractions, decimals, or percentages to quantify the likelihood of events.

Features:

- Emphasizes clarity in defining events.
- Encourages visualization through diagrams like tree diagrams and Venn diagrams.

2. Combinatorics and Counting Techniques

Probability calculations often rely on counting the number of favorable outcomes relative to total possible outcomes. IB Math covers:

- Permutations: arrangements where order matters.
- Combinations: selections where order is irrelevant.
- Applications: calculating outcomes in games, lotteries, and arrangements.

Pros and Cons:

- Pros: Provides essential tools for complex probability problems.
- Cons: Can be challenging for students unfamiliar with combinatorics; requires practice to master.

3. Conditional Probability and Independence

This segment explores how the probability of an event can change based on new information:

- Conditional Probability: $P(A|B) = \frac{P(A \cap B)}{P(B)}$
- Independence: When the occurrence of one event does not affect the probability of another.

Features:

- Critical for understanding real-world scenarios where events are related.
- Introduces Bayes' Theorem, enabling the updating of probabilities based on evidence.

4. Discrete Probability Distributions

Students learn about models that describe the probability of different outcomes:

- Binomial Distribution: For a fixed number of independent Bernoulli trials with two outcomes.
- Poisson Distribution: For counting the number of events in a fixed interval or space.

Features:

- Emphasizes calculating expected values and variances.
- Relevant for modeling real phenomena like queueing systems or radioactive decay.

5. Continuous Probability Distributions (Optional in some courses)

Some IB courses introduce continuous distributions like the normal distribution, which is vital for statistical inference:

- Normal Distribution: Bell-shaped curve characterized by mean and standard deviation.
- Applications: Natural phenomena, measurement errors.

Pros:

- Bridges the gap between pure probability and statistics.
- Provides tools for hypothesis testing and confidence intervals.

Application of Probability in IB Math

Probability in IB Math isn't just theoretical; it has numerous practical applications that help students see the relevance of mathematical concepts:

Statistical Data Analysis

Students learn to interpret data sets, assess probabilities of various outcomes, and understand variability and uncertainty. This prepares them for IB internal assessments and real-world data

handling.

Decision Making and Risk Analysis

By understanding probabilities, students can evaluate risks and benefits, crucial in fields like finance, medicine, and engineering.

Modeling Real-World Phenomena

Probability models help simulate and analyze scenarios such as traffic flow, population dynamics, and quality control processes.

Strengths and Features of IB Probability Curriculum

- Comprehensive Scope: Covers both fundamental and advanced topics, ensuring well-rounded understanding.
- Emphasis on Visualization: Use of diagrams (tree, Venn, histograms) enhances conceptual clarity.
- Interdisciplinary Links: Connects well with statistics, algebra, and calculus.
- Focus on Problem-Solving: Encourages applying concepts to real-life and exam-style questions.

Potential Challenges and Limitations

- Abstract Concepts: Some students find topics like conditional probability and distributions challenging without concrete examples.
- Complex Calculations: Combinatorics and probability distributions can involve intricate calculations, requiring practice.
- Balancing Theory and Application: Ensuring students grasp theoretical principles while being able to apply them practically can be demanding.

Tips for Success in IB Math Probability

- Master Basic Concepts First: Ensure a solid understanding of probability axioms and basic counting techniques before progressing.
- Use Visual Aids: Diagrams like tree diagrams and Venn diagrams clarify complex scenarios.
- Practice Extensively: Solve a variety of problems from past IB papers and supplementary exercises.
- Understand Context: Relate probability problems to real-world contexts to enhance

comprehension.

- Review Theoretical Foundations: Grasp the derivation and rationale behind formulas, especially for distributions and Bayes' Theorem.
- Work Collaboratively: Discuss problems with peers to gain different perspectives and insights.

Conclusion

IB Math Probability is a vital component that equips students with essential skills for understanding uncertainty, analyzing data, and making informed decisions. Its curriculum balances theoretical rigor with practical application, fostering both mathematical reasoning and real-world problem-solving abilities. While some topics pose challenges, consistent practice, visualization, and conceptual understanding can lead to mastery and success in IB assessments. Ultimately, probability not only enriches the mathematical toolkit but also empowers students to navigate an increasingly data-driven world with confidence and insight.

Question How do I calculate the probability of multiple independent events occurring together in IB Math? For independent events, multiply their individual probabilities. For example, the probability of both event A and event B occurring is $P(A) \times P(B)$. What is the difference between classical, empirical, and subjective probability in IB Math? Classical probability is based on equally likely outcomes, empirical probability is derived from experimental data, and subjective probability reflects personal judgment or belief about an event's likelihood. How can I use probability distributions, like binomial and normal, to solve IB Math problems? Identify the type of problem and the distribution that models it. Use the probability mass function (binomial) or probability density function (normal) to find probabilities, often involving calculations of mean, variance, or z-scores. What are some common pitfalls when solving probability questions in IB Math? Common pitfalls include misidentifying dependent vs. independent events, forgetting to normalize probabilities, mixing up different probability rules, and not carefully interpreting the problem context. How do I approach word problems involving conditional probability in IB Math? Identify the given conditions, set up the conditional probability formula $P(A|B) = P(A \cap B) / P(B)$, and carefully calculate the joint and marginal probabilities to find the answer.

Related keywords: IB Math probability, probability theory, probability formulas, probability distributions, binomial probability, probability calculations, probability concepts, IB Math statistics, probability exercises, probability problems

Read the full article online: [Ib math probability](#)