Welcome to the 2014 Interschool test! During this examination, you and your teammates will brave five categories that will tease your brain and test your knowledge on a given topic.

The categories are:

**1. SPORTS 2. ECONOMICS 3. POP CULTURE 4. THE SCIENCES 5. POTPOURRI**

But wait…no math? Not to worry, math and numbers are interwoven throughout the test. After all, we can never really get away from them.

Except for Potpourri, each category will have two parts, a trivia section and a problems section. Each trivia question is worth 1 point, while each problem is worth 2 points. Point values will be stated within the Potpourri category.

Good luck, and have fun!

**SPORTS**

**I: Trivia…by the Numbers**

1. 6: The most Super Bowl wins by any NFL team. What team is this?

2. a) 28: The highest number of claimed national football championships by any college or university. What school holds this record? (Hint: think of the days before the Poll Era.)

b) The number is 9 since the Poll Era (1936 to the present). What school holds this record?

3. Assign the following numbers to the respective positions: 1 – Pitcher, 2 – Catcher, 3 – First Base, 4 – Second Base, 5 – Third Base, 6 – Shortstop, 7 – Outfield.

Babe Ruth played three different positions during his professional career. Find the sum of the numbers of these three positions.

4. California is the state that hosts the greatest number of Major League Baseball teams. How many teams is that?

5. The year is 1992. 12 men, including Michael Jordan, Magic Johnson, and Larry Bird. Give the official nickname of this squad.

6. 102: The most points scored by one basketball player in one game. Name this player.

7. 7 is a lucky number. It is the most Grand Slam singles titles any one male tennis player has won at a given tournament. For example, William Larned and Richard Sears each won 7 titles at the US Open.

a) Who has this record at the French Open?

b) Give the name of one of the three men who share this record at Wimbledon.

8. This country boasts the most World Cup soccer championships with 5, but cannot claim to have the most top-3 finishes.

**II: Math/Logic Applications**

1. LeBron James, Kobe Bryant, Kevin Durant, and 5 other NBA stars want to set up a one-on-one tournament to determine who the best basketball player is. Each player will face the other players exactly once. However, LeBron, as the reigning MVP, says that he will not play in the tournament, but rather challenge the winner. Including this final matchup, how many games will be played?

2. Olympic badminton is a high-speed sport. The shuttlecock can reach travel speeds of 200 miles per hour off of a player’s racquet. However, the air resistance on the shuttlecock is very high, providing a negative acceleration of -47 miles per minute squared. At what speed (in miles per hour) does the opposing player encounter the shuttlecock if the time between racquet hits is exactly 1 second?

3. Usain Bolt runs one mile south, one mile west, and one mile north, only to find himself right where he started! Thinking he really is super-human, Bolt now runs one mile north, then one mile west, then one mile south. He is disappointed to find the trick did not work the second time. Briefly explain what happened on the first run. We are especially looking for a description of his starting location.

4. Kyle Busch and Danica Patrick, two NASCAR drivers, are the two finalists in a different sort of race. The President of the United States established that whoever’s racecar reached the White House *last* would win the competition. After driving about the country for days, they both approach you for guidance. Upon receiving your advice, they climb into the cars and speed away towards the White House as fast as possible. What did you tell them?

**ECONOMICS**

**I: History and Basics**

1. Who is generally considered the father of economics and capitalism? If you’re stuck, sit back and let his invisible hand do the writing.

2. Appearing to go against the ideas of the man in the preceding question, most economists believe the free market does not function properly in the presence of these.

3. John Nash, Princeton graduate and the father of Game Theory, won a Nobel Prize in Economics for his work.

a) Before we get to Nash, what about this Nobel guy? How did he make his fortune?

b) Nash’s life story seems deserving of a movie. In fact, there already is one. What is it called?

Psychology and Economics often overlap…

c) From what disorder did Nash suffer?

d) One famous game shares a venue with a Stanford psychology experiment. What is the name of the game?

4. Two key economic theories dictating government intervention have been developed. Put simply, Supply-Side Economics attempts to shift the nation’s supply curve outward. Another type attempts to shift the nation’s demand curve.

a) What president is most associated with Supply-Side Economics?

b) The demand-shifting theory is the brainchild of its namesake. Name the man.

5. Who am I? Each clue will give definitions of two terms that sound similar, but you should only write down the one for which the question asks.

a) I am not a solitary seller, but rather a single buyer.

b) I make average total cost decrease, not as the quantity produced increases, but as the diversity of products grows.

c) I measure the value of goods produced, not by everyone within a country, but by all citizens of a country.

d) I represent a market with more than one producer, but unlike my counterpart where price equals marginal revenue, types of me include oligopoly and monopolistic competition.

e) I represent economic analysis, not based on how the world actually is, but how it ought to be.

**II: Economics is really just applied math**

1. Suppose the demand for Sappington’s Widgets is represented by QD = 150 – 50P, and the supply is given by QS = 60 + 40P. Price units are dollars.

a) What is the marginal cost (in dollars) of producing an additional widget?

b) Now, to the disgust of the supplier, the government demands a tax of $0.50 on each widget sold. Equally disgusted are the consumers, who, of course, have to share some of the tax burden. Calculate the price that a consumer must pay for a widget (Pb). Hint: Construct a system of 4 equations in 4 variables, one of which is: P*b*- P*s* = 0.50.

c) Calculate the deadweight loss created by this tax. Deadweight loss represents the amount of lost consumer and producer surplus that is not taken in by the government, and can be calculated as .5\*Change in quantity sold\*Difference between price paid by the buyer and collected by the seller.

2. The Fraz has utility function represented by: $\left(w\right)= a\sqrt{w}+b$ , where $w$ represents his wealth (in dollars).

a) An individual is said to be “risk averse” if the first derivative of his utility function is decreasing in $w$. For what values of $a$ and $b$ is the Fraz risk averse?

b) Assume now that $a=1$ and $b=0$. Right now, the Fraz has $400. The probability that he has an accident, in which he would lose $300, is 0.1. The Fraz has the option to purchase an insurance policy which would return the lost $300 in the case of an accident. At what insurance price is the Fraz indifferent between purchasing insurance and not purchasing it?

**POP CULTURE**

**I: Some multiple choice**

As always, NOTA indicates “None Of These Answers” is correct.

1. Which of the following athletes has Kim Kardashian NOT dated?

A) Miles Austin B) Reggie Bush C) Kris Humphries D) Lamar Odom E) NOTA

2. How many times has Brittney Spears been married (and divorced)?

A) 0 – never divorced B) 1 C) 2 D) 3 E) NOTA

3. Which of the following is NOT a Lady Gaga song?

A) Love Game B) Alejandro C) Poker Face D) Monster E) NOTA

4. Skrillex hit “Cinema” takes sections of the original song “Cinema” by which artist?

A) Benny Benassi B) Kid Cudi C) Richard Dawkins D) Avicii E) NOTA

5. What actress plays Professor McGonagall in the Harry Potter series?

A) Julie Andrews B) Peggy Ashcroft C) Hermione Baddeley D) Maggie Smith E) NOTA

6. Seth MacFarlane contributed to all of the following EXCEPT:

A) Family Guy B) The Fairly OddParents C) Ted D) Dexter’s Laboratory E) NOTA

7. “So this is a Harvard bar, huh? I thought there’d be equations…on the wall.” This is a quote from what movie?

A) Good Will Hunting B) Legally Blonde C) The Firm D) The Social Network E) NOTA

8. On what sitcom are you likely to hear the phrase “Hello, Newman”?

A) Cheers B) Frasier C) Seinfeld D) Friends E) NOTA

9. Which artist had an album titled “Magical Mystery Tour”?

A) Led Zeppelin B) Grateful Dead C) The Beatles D) The Band E) NOTA

10. Which of these women started modeling at the age of 14?

A) Anne Hathaway B) Angelina Jolie C) Jennifer Aniston D) Mila Kunis E) NOTA

**II: Stuff the stars could never figure out for themselves**

1. Many years down the line, Justin and Selena are a (happily?) married couple. They have two young children, one of which is a girl. Assume that the probability of having a boy is equal to that of having a girl. What is the probability that the other child is also a girl?

2. After getting sick of Dr. House’s sarcasm, Wilson decides to try to stump House in a number puzzle. In order to follow up on a possible diagnosis, House needs to know the ages of children of his patient. He asks Wilson, who says:

“Well, Dr. House, there are three children and the product of their ages is 36.”

“That is not enough information,” says House.

“The sum of their ages is exactly the number of patients you have ticked off this week.”

“That is still not enough,” responds the doctor.

“Ok, the last thing is that the oldest child has the same illness as the mother.”

With that, Dr. House leaves the room to talk to the patient, knowing exactly what he needed to know. How old were each of the children?

3. You are a contestant on “Let’s Make a Deal” (a game show that used to be more popular). You are shown three doors. The host tells you that behind one of the doors there is a car, while behind the other two there are mystery prizes of significantly lesser value. You select a door, then the host, knowing which door contains the car, opens one of the other doors to reveal a foosball table. You could keep the foosball table, but you opt to keep playing, hoping for the car. Now, the host gives you the opportunity to switch doors. What should you do? (Write “Switch,” “No Switch,” or “Does not matter.”) Also, justify your answer by giving the probability of winning the car if you switch doors.

4. At the end of the TV series “The Bachelor Pad,” a “game” is played to determine who wins money. Two contestants remain at the time of the game, and $250,000 are at stake. Separately, the two contestants will make the choice to either KEEP or SHARE the money. But it is not quite so simple. If both contestants elect to SHARE, the money is split between the two. If one elects to KEEP and the other elects to SHARE, the contestant who said KEEP gets all of the money. Finally, if both say KEEP, then neither contestant gets any money. Assuming that both players are strategizing only for the money (and not for a lasting relationship), and that all contestants would prefer that both get nothing rather than the other person taking it all, what should any given contestant say…KEEP or SHARE?

Hint: Our friend John Nash might have some insight.

**THE SCIENCES**

**I. Who says mathematicians can’t be scientists?**

1. If a reactant contains an atom that gains electrons, it is known as a(n)?

2. The “Loop Rule” and the “Junction Rule” can be applied to any circuit and are together known as this, named after their creator.

3. What is the name for the margin where two plates in the lithosphere slide past each other?

4. This effects of this “force” result in a wide number of natural phenomena, including hurricanes and the trade winds.

5. What is the term for the error of a compass as a consequence of the difference between magnetic North and true North?

6. Order the following elements in dry weight percent make-up in the human body, from the lowest percent to the highest percent content: Calcium, Nitrogen, Carbon, Magnesium.

7. Parkinson’s disease is caused by a lack of this neurotransmitter in the brain.

8. What greenhouse gas has the greatest heat-trapping ability per molecule?

9. How many blowholes does a killer whale have? How about a humpback whale? (Give the two answers in order and separated by a semicolon.)

10. How many ATP are made from the energy released from the breakdown of one glucose molecule?

**II. A few problems**

1. A Petri dish hosts a healthy colony of bacteria. Once a minute every bacterium divides into two. The colony was founded by a single cell at noon. At exactly 12:43 (43 minutes later) the Petri dish was half full. At what time will the dish be full?

2. The Hardy-Weinberg formulas represent a common method for solving population dynamics problems. To refresh your memory, some basics of the Hardy-Weinberg Equilibrium are:

*p* = the frequency of the dominant allele

*q* = the frequency of the recessive allele

*p* + *q* = 1

In a certain population of 1000 fruit flies, 640 have red eyes while the remainder have sepia eyes. The sepia eye trait is recessive to red eyes. How many individuals would you expect to be homozygous for red eye color?

3. Balance the following chemical equation by finding the values of constants *a, b, c,* and *d.* The answer to this problem is *a* + *b* – *c* + *d*.

*a*H3PO4 + *b*Mg(OH)2 → *c*Mg3(PO4)2 + *d*H2O

4. A particle travels in a circular path of radius 0.2 m with constant kinetic energy of 4 J. What is the net force (in Newtons) on the particle?

5. The plates of a capacitor are charged to a potential difference of 5 V. If the capacitance is 2 mF, what is the charge on the positive plate (in Coulombs)?

**POTPOURRI**

**I.** Identify the corporate logo. 1/4 point each.



**II.** Some riddles and logic questions. 1 point each.

1. Brothers and sisters I have none but this man's father is my father's son.
 Who is the man?

2. As I was going to Saint Ives,
I crossed the path of seven wives.
Every wife had seven sacks,
Every sack had seven cats,
Every cat had seven kittens,
Kittens, cats, sacks, wives,
How many were going to Saint Ives?

3. Who makes it, has no need of it.
 Who buys it, has no use for it.
 Who uses it can neither see nor feel it.
 What is it?

4. Two children, who could not recall the day of the week, paused on their way to school to straighten matters out. "When the day after tomorrow is yesterday," said Priscilla, "then 'today' will be as far from Sunday as that day was which was 'today' when the day before yesterday was tomorrow!" On which day of the week did this puzzling prattle occur?

5. A ladder hangs over the side of a ship anchored in a port. The bottom rung touches the water. The distance between rungs is 20 cm and the length of the ladder is 180 cm. The tide is rising at the rate of 15 cm each hour. When will the water reach the seventh rung from the top?

6. A girl who was just learning to drive went down a one-way street in the wrong direction, but didn't break the law. How come?

7. Sir, I bear a rhyme excelling
In mystic force and magic spelling
Celestial sprites elucidate
All my own striving can't relate

8. Bryan lies every Monday, Tuesday and Wednesday and the other days he speaks the truth. Jackson lies on Thursdays, Fridays and Saturdays, however the other days of the week he speaks the truth. Bryan says, “Yesterday I was lying.” Jackson responds “So was I.” On which day of the week did they say that?

9. There are people and strange monkeys on this island, and you cannot tell who is who. They speak either only the truth or only lies. Who are the following two guys? Write either “lying monkey”, “lying man”, “truthful monkey”, or “truthful man” for each. (1 point per part.)
A says: B is a lying monkey. I am human.
B says: A is telling the truth.

10. There once was a woman named Pandora, who would only give her daughter birthday presents if she could figure out where to look for them. Below are the puzzles from two past years:

a) Based upon the inscriptions on the boxes (none or just one of them is true), choose one box where the presents are hidden.

 **Golden box Silver box Lead box**
The presents are in this box. The presents aren’t in this box. The presents aren’t in the golden box.

b) At least one inscription is true and at least one is false. Choose the box with the presents.

 **Golden box Silver box Lead box**
The presents aren’t in the silver box. The presents aren’t in this box. The presents are in this box.

**III.** Fill in the missing words to write the phrase. For example, If shown “26 L of the A”, you would write “26 Letters of the Alphabet”. More examples: 7 D of the W - 7 Days of the Week,

3 B M (S H T R) - 3 Blind Mice (See How They Run). Got it? Good. ½ point each.

1. 60 M in an H

2. 12 S of the Z

3. 13 S in the U S F
4. 90 D in a R A

5. 100 C in a D

6. 13 L in a B D

7. 7 W of the W

8. 9 L of a C

9. 23 P of C in the H B

10. 32 is the T in D F at which W F