

THE PROFESSOR J.T. CAMPBELL YEAR 11 MATHEMATICS COMPETITION - 2015

Time allowed: 40 minutes

Each question is awarded a different number of marks so please check marks carefully.

Answer questions in any order.

No working is required – just write the answers on the answer sheet provided.

Question 1: [1 mark]

“Sir, I have a rhyme assisting

My feeble brain; it’s terribly resisting”

This rhyme helps you remember what?

Question 2: [2 marks]

A sequence starts with a 3 and the seventh term is 71. so the sequence looks like this:

3, , , , , , 71, ,

The sequence is Fibonacci so that each term after the first two terms is obtained by adding the two previous numbers (eg 1,3,4,7,11,18,...). What is the value of the 8th term?

Question 3: [2 marks]

There are 5 integers between 0 and 100 such that the mode is 90, the median 85 and the mean 83. What is the lowest possible integer that could be present?

Question 4: [2 marks]

The chart shows the distance in kilometres between 4 villages

How far is it from A to B?

	A	B	C	D
A			21	
B				7
C		5		12
D	9			

Question 5: [3 marks]

An 8 digit number contains two 1s, two 2s, two 3s and two 4s.

The 1s are separated by one digit, the 2s by two digits, the 3s by three digits and the 4s by four digits. There are two such numbers; what are they?

Question 6: [2 marks]

80 people play in a knock-out singles tournament so that a player losing a match is out of the tournament. How many matches need to be played to find a winner?

Question 7: [2 marks]

What is the next term in each of these sequences?

(a) 1 2 4 7 12 18 25 34 44 55 _____

(b) 5 9 16 28 46 74 113 165 231 315 _____

Question 8: [3 marks]

A mother presented this problem to her daughter:

"I have 3 boxes, each containing an exact number of dollars. If you can guess the total amount in all 3 boxes, the money is yours. Here are three clues:

1. The product of the three amounts is 15300
2. Two of the boxes contain the same amount.
3. The sum of the digits in the total amount is equal to your only brother's age in years.

I will also allow you to ask one question – if you choose the correct question, you should have no doubt about the total".

The daughter then asks, "Does any box contain fewer dollars than my brother's age?"

"No," the mother answers. How much money in total was in the three boxes?

Question 9: [2 marks]

During one school holidays it rained on 13 days, but when it rained in the morning the afternoon was fine, and every rainy afternoon was preceded by a fine morning. There were 11 fine mornings and 12 fine afternoons. How long was the holiday?

Question 10: [2 marks]

Every red car in a car showroom is a sports car. Half of the blue cars are also sports cars. Half of all the sports cars are red. There are 40 blue cars and 30 red cars in the showroom. How many sports cars are neither red nor blue

Question 11: [4 marks]

On the island of BulaBula they play a game called batball which is almost identical to softball.

In batball the two teams have a minimum of seven innings each, the teams taking it in turn to bat. A batter is out if either she is caught or if she misses three successive pitches, and an innings finishes when three players are out. The whole game finishes as soon as one team has an unbeatable lead in terms of runs scored.

In a game between the Yams and the Taros, the Yams had the same pitcher throughout and she threw the minimum possible number of pitches.

- (a) Who won the game?
 - (b) What was the final score?
 - (c) Which team batted first?
 - (d) How many pitches did the Yams pitcher make?
-

Question 12: [2 marks]

1. David gets the socks if Fred gets the tie
2. David gets the cigars if George gets the socks
3. David gets the tie if Fred gets the cigars
4. George gets the socks only if David gets the tie
5. Fred gets the cigars if George gets the tie

Who gets what?

Question 13: [2 marks]

Split all the twelve whole numbers from 1 to 12 into two groups such that

- set A has four consecutive numbers
 - the sum of the numbers in B is twice the sum in A
-

Question 14: [3 marks]

Max and James started with the same number of counters and played 5 games. At the end of each game, the loser had to give the winner one third of his counters. Max lost the first three games but won the next two, and ended up with 118 more counters than James. How many counters did they each have at the start?

Question 15: [2 marks]

In the year 65BC, Marcus was half as old as Julius. Thirty six years later, the age of Marcus was three quarters of Julius' age. In what year was Julius born?

Question 16: [2 marks]

Both a SPLIT and an ENZ are cuboids (box-shaped objects).

Using the information what is the ratio of volume of a SPLIT to the volume of an ENZ?

- A NEIL is equal to six FINNS
 - The top of a SPLIT measures one FINN by one FINN
 - The top of an ENZ measures one NEIL by one NEIL
 - A SPLIT is one NEIL in depth
 - An ENZ is one FINN in depth
-

Question 17: [3 marks]

A bag contains $\frac{2}{3}$ as many 20¢ coins as it does 50¢ coins, five times as many 10¢ coins as 20¢ coins and half as many 5¢ coins as 10¢ coins, making a total of \$6.30. How many of each coin is there in the bag?

Question 18: [3 marks]

$\pi = 3.141593$ (to 6 dp)

Hundreds of years ago a Chinese astronomer estimated a value for π in the form $\frac{abb}{cca}$ (where a,b,c are different digits) which was accurate to 6dp

With a bit of help from your calculator find values of a,b and c.

YEAR 11 MATHSWELL 2015			Names	1.	
School:				2.	
Time allowed: 40 minutes				3.	
STUDENT ANSWER SHEET					MARK
1.				(1)	
2.	8 th term is			(2)	
3.	Lowest possible integer is			(2)	
4.	Distance between A and B is			(2)	
5.	Two numbers are (a)		(b)	(3)	
6.	Number of matches to be played is			(2)	
7.	Next term in the sequence (a)		(b)	(2)	
8.	Total amount of money in the three boxes is			(3)	
9.	Number of days in the holiday is			(2)	
10.	Number of sports cars neither red nor blue is			(2)	
11.	winner	score	batted first	pitches	(4)
12.	David gets	George gets	Fred gets		(2)
13.	Set A		Set B		(2)
14.	Number of counters each person had is			(3)	
15.	Julius was born in			(2)	
16.	Ratio of volume SPLIT: Volume ENZ = :			(2)	
17.	5c coins	10c coins	20c coins	50c coins	(3)
18.	a =	b =	c =		(3)
TOTAL				42	

YEAR 11 MATHSWELL 2015							
School:							
Time allowed: 40 minutes							
MARKER ANSWER SHEET							MARK
1.	π /				(1)		
2.	8 th term is 115 //				(2)		
3.	Lowest possible integer is 66 // (65 gets /)				(2)		
4.	Distance between A and B is 16 //				(2)		
5.	Two numbers are (a) 4 1 3 1 2 4 3 2 (b) 2 3 4 2 1 3 1 4 both /// one /				(3)		
6.	Number of matches to be played is 79 //				(2)		
7.	Next term in the sequence (a) 68 / (b) 418 /				(2)		
8.	Total amount of money in the three boxes is 77 ///				(3)		
9.	Number of days in the holiday is 18 //				(2)		
10.	Number of sports cars neither red nor blue is 10 //				(2)		
11.	Winner Taros /	Score 1-0 /	batted first Yams /	Pitches 19 /	(4)		
12.	David gets socks George gets cigars Fred gets tie //				(2)		
13.	Set A 5, 6, 7, 8 B 1, 2, 3, 4, 9, 10, 11, 12 //				(2)		
14.	Number of counters each person had is 243 ///				(3)		
15.	Julius was born in 101 BC // (29 BC gets /)				(2)		
16.	Ratio of volume SPLIT: Volume ENZ = 1 : 6 //				(2)		
17.	5c coins 10	10c coins 20	20c coins	50c coins 6 ///	(3)		
18.	a = 3 / b = 5 / c = 1 /				(3)		
TOTAL					42		

1. Number of letters in each successive word gives digits of π 3.14159265389
2. If b is 2nd term, next terms are $3+b$, $3+2b$, $6+3b$, $9+5b$, $15+8b$, $24+13b$. So $15+8b=71$, $b=7$, and 8th term =115
3. Numbers must be $x, y, 85, 90, 90$ with total $=5x+83=415$ so $x+y = 150$. Max $y=84$ (to give median=85)so min $x = 66$
4. $AD+DC=21=AC$ so ADC in straight line Similarly B between C and D so towns in order ADBC so $AB=AD+DB=16$
5. Guess and check , using as a start that the two 4s have 4 digitgs between them which limits their possible poisiitions to either 1st and 6th, 2nd and 7th, or 3rd and 8th givng either 4 1 3 1 2 4 3 2 or in reverse order.
6. In each match one player is knockerd out. In total 79 plasyers are knocked out so 79 matches
7. a. 1 2 4 7 12 18 25 34 44 55
1 2 3 5 6 7 9 10 11
1 1 2 1 1 2 1 1
Next 2nd difference = 2 so $55+13=68$

b. 5 9 16 28 46 74 113 165 231 315
4 7 12 18 28 39 52 66 84
3 5 6 10 11 13 14 18
2 1 4 1 2 1 4
Next 3rd difference = 1, so 19 is 2nd diff and $103 = 1^{st}$ diff giving $315+103 = 418$
8. $15300 = 2^2 \times 3^2 \times 5^2 \times 17$ so two boxes same gives 1,1,15300 or 2,2,3825 or 3,3,1700 or 5,5,612 or 10,10,153 or 15,15,68 or 30,30,17
Totals 15302(digit total 11), 3829 (22), 1706(14), 622(10),173(11), 98(17), 77(14).
Brother must be 14 (otherwise she didn't need to ask question) so 30,30,17 =77
9.

	am	pm	let $x =$ wet am
wet	x	$13-x$	$x+11=25-x$ so $x = 7$
fine	<u>11</u>	<u>12</u>	giving $x+11=25-x$
	$x+11$	$25-x$	$=18$ days
10. 30 red sports so 60 sports in all. 40 blue cars so 20 blue sports. $60-30-20 = 10$ sports cars neither blue nor red
11. Must go at least 7 innings to have an unbeatable lead. 6 innings require 18 pitches so overall minimum is 19 pitches if winning run is made on the first pitch of 7th innings. In this case it must be the innings of the 2nd team, since they can't be caught by team batting first. So Taros won the game 1-0 with the Yams batting first and 19 pitches needed
12. G tie \rightarrow F cigars(5) \rightarrow D tie(3) \rightarrow contradiction
D tie \rightarrow G socks(4) \rightarrow D cigars(2) \rightarrow contradiction
so F must get tie \rightarrow D socks(1) \rightarrow G cigars
13. $\text{sum } 1-12 = 78$ so set A adds to $78/3=26$
A= 5,6,7,8 B 1,2,3,4,9,10,11,12
14. each start with x so total= $2x$
M $\frac{2}{3}x$ $\frac{4}{9}x$ $\frac{8}{27}x$ $\frac{70}{81}x$ $\frac{302}{243}x$
J $\frac{4}{3}x$ $\frac{14}{9}x$ $\frac{46}{27}x$ $\frac{92}{81}x$ $\frac{184}{243}x$
difference = $\frac{118}{243}x = 118$ so $x = 243$
15. $M = \frac{1}{2}J$; $M+36 = \frac{3}{4}(J+36) = \frac{3}{4}(2M+36) = 1\frac{1}{2}M+27$; $M=18, J=36$ so born in 101BC
16. $\text{vol } S = F^2N = 6F^3$ $\text{vol } E = N^2F = 36F^3$ so 1:6
17. x 5c, $2x$ 10c, $\frac{2}{5}x$ 20c, $\frac{3}{5}x$ 50c . Total = $630 = 5x+20x+8x+30x=63x$ so $x=10$.
So 10 5c, 20 10c, 4 20c, 6 50c
18. Guess and check – value of c is either 1 or 2 so start with mutliplying π by $11x$ for different x and trying to get a whole number. $113\pi=354.999$ so $355/113$