

THE PROFESSOR J.T. CAMPBELL YEAR 11 MATHEMATICS COMPETITION - 2013

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: [3 marks]

a , b and c are positive integers with $a \times b = 13$, $b \times c = 52$, and $c \times a = 4$.

Find the values of a , b and c .

Question 2: [2 marks]

2.54 cm = one inch and 2.205 pounds = one kilogram.

(a) What does one kg per square cm equal in pounds per square inch.

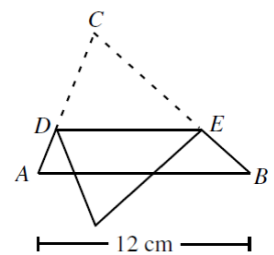
(b) What does a tyre pressure of 2.0 kg per square cm equal, when changed to pounds per square inch.

Write all answers to 3 significant figures.

Question 3: [3 marks]

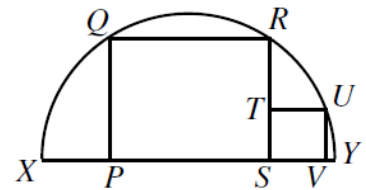
The base of a triangular piece of paper ABC is 12 cm long.

The paper is folded down over the base, with the crease DE parallel to the base of the paper. The area of the triangle that projects below the base is 16% that of the area of the triangle ABC. Find the length of DE, in cm.



Question 4: [2 marks]

In the diagram, a semi-circle has diameter XY. Rectangle PQRS is inscribed in the semi-circle with PQ = 12 and QR = 28. Square STUV has T on RS, U on the semi-circle and V on XY. Calculate the area of STUV.



Question 5: [3 marks]

The arithmetic sequence $a, a+d, a+2d, a+3d, \dots, a+(n-1)d$ has the following properties:

- When the first, third, and fifth, and so on terms are added, up to and including the last term, the sum is 320.
- When the first, fourth, seventh, and so on, terms are added, up to and including the last term, the sum is 224.

What is the sum of the whole sequence?

Question 6: [3 marks]

A quarter circle is folded to form a cone. If θ° is the angle between the axis of symmetry and the slant height of the cone, then find the value of θ° . (*Answer to the nearest tenth of a degree*)

Question 7: [3 marks]

Find the values of x , y and z if they satisfy the following system of equations:

$$\begin{aligned}x + y + z &= 5 \\x^2 + y^2 + z^2 &= 15 \\xy &= z^2\end{aligned}$$

Question 8: [4 marks]

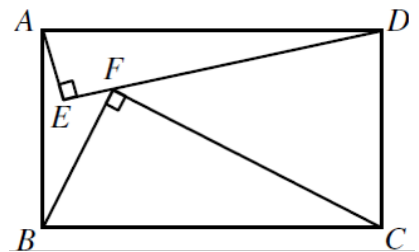
Different letters stand for different digits in this sum.

What numbers do the letters S, A, G and E stand for?

$$\begin{array}{r}L\ E\ G\ S \\+ S\ A\ G\ E \\G\ A\ M\ M\ A\end{array}$$

Question 9: [3 marks]

In the diagram, right-angled triangles AED and BFC are constructed inside rectangle ABCD so that F lies on DE. $AE = 21$, $ED = 72$ and $BF = 45$. Calculate the lengths of AD, FC and CD.



Question 10: [3 marks]

There are 81 Subaru cars in a car sales yard. They are all Legacys, Imprezas or Foresters. There are half as many Imprezas as Foresters. The number of Legacys is 80% of the number of Imprezas and Foresters together. How many of each type of car are there?

Question 11: [2 marks]

$$1 \times 2 \times 3 \times 4 \times 5 \times 6 = 8 \times 9 \times 10$$

$8 \times 9 \times 10 \times 11 \times 12 \times 13 \times 14$ is equal to another such product of consecutive whole numbers.

What is the smallest and largest numbers of this other product?

Question 12: [2 marks]

A quadrilateral ABCD has $AB = AD = 5$, $CB = CD = 1$ and a right angle at C.

- Find the area of the quadrilateral
 - Find the angle A.
-

Question 13: [4 marks]

Find the next two terms in each sequence:

(a) 7, 11, 15, 19, 23, ____, ____

(b) 2, 6, 12, 20, 30, ____, ____

(c) $\frac{1}{3}$, $\frac{1}{2}$, $\frac{3}{5}$, $\frac{2}{3}$, $\frac{5}{7}$, ____, ____

(d) 1, 0, -1, 0, 7, 28, ____, ____

Question 14: [4 marks]

A family of four (father, mother, son and daughter) went out to dinner. They each had a different entrée, main course and dessert.

Entree: garlic prawns, soup, scallops, spring rolls

Main course: salmon, pork, lamb, steak

Dessert: brownie, crème brulee, cheesecake, sorbet

Determine the meal eaten by each member of the family according to these clues:

- One child had lamb and the other had garlic prawns
- One of the females had crème brulee and the other had pork
- The father sat on the right of the person who had cheese cake, who sat on the right of the person who had pork, who sat on the right of the person who had soup, who sat on the right of the person who had a brownie
- One parent had scallops and the other had steak
- One of the males had steak and the other had garlic prawns.

Question 15: [2 marks]

When $(1 - 2x)^3(kx + 1)^2$ is expanded, the coefficient of x^2 is 40.

Find the values of k when this occurs.

Question 16: [3 marks]

A, B, C, D and E are five different whole number between 1 and 5 inclusive.

They are arranged in a square grid as shown.

The first row has a total of 9 and the middle column has a total of 10.

It is known that the total for each row and column is different.

Find the values of A, B, C, D and E.

A	B	C	9
B	E	D	
E	C	A	10

Question 17: [2 marks]

When you reverse the numbers of 36, the number increases by 27 (ie $63 = 37 + 27$).

How many other two-digit numbers increase by 27 when their numbers are reversed, and what are they?

Question 18: [2 marks]

Four terms in an arithmetic sequence add to give 150 and their squares add to give 5750.

What are the four terms?

YEAR 11 MATHSWELL 2013			Names	1.	
School:				2.	
Time allowed: 40 minutes				3.	
ANSWERS					MARK
1.	a =	b =	c =	(3)	
2.	(a)	(b)		(2)	
3.				(3)	
4.				(2)	
5.				(3)	
6.				(3)	
7.	x =	y =	z =	(3)	
8.	S =	A =	G =	E =	(4)
9.	AD =	FC =	CD =	(3)	
10.	Legacys =	Imprezas =	Foresters =	(3)	
11.	Smallest =	Largest =		(2)	
12.	(a)	(b)		(2)	

13.	(a)	(b)	(4)			
	(c)	(d)				
14.	father	mother	(4)			
	son	daughter				
15.			(2)			
16.	A =	B =	C =	D =	E =	(3)
17.			(2)			
18.			(2)			
TOTAL					50	

YEAR 11 MATHSWELL 2013			Names	1.	
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ANSWERS					MARK
1.	a = 1	b = 13	c = 4	(3)	
2.	(a) 14.2	(b) 28.4		(2)	
3.	8.4 (cm ²) <i>Units not important</i>			(3)	
4.	16 <i>3 marks for correct answer, no working marks</i>			(2)	

5.	608	<i>3 marks for correct answer, no working marks</i>			(3)	
6.	14.5°	<i>3 marks for correct answer, no working marks</i>			(3)	
7.	$x = 2 \pm \sqrt{3}$ 3.732, 0.268	$y = 2 \mp \sqrt{3}$ 0.268, 3.732	$z = 1$		(3)	
<i>Any rounding</i>						
8.	S = 5	A = 4	G = 1	E = 9	(4)	
9.	AD = 75	FC = 60	CD = 50		(3)	
10.	Legacys = 36	Imprezas = 15	Foresters = 30		(3)	
11.	Smallest = 63		Largest = 66		(2)	
12.	(a) 4		(b) 16.3°		(2)	
13.	(a) 27, 31		(b) 42, 56		(4)	
	(c) $\frac{3}{4}, \frac{7}{9}$ <i>must simplify fraction</i>		(d) 79, 192			
<i>Half marks for each correct answer</i>						
14.	Father – spring rolls, steak, brownie		Mother – scallops, pork, sorbet		(4)	
	Son – garlic prawns, salmon. cheesecake		Daughter – soup, lamb, crème brulee			
15.	-2 or 14 (<i>any order, one mark each</i>)				(2)	
16.	A=3	B=5	C=1	D=2	E=4	(3)
<i>Half mark each, 3 marks for all correct</i>						

17.	14, 25, 47, 58, 69 <i>2 marks for all correct; half mark off for each one missing</i>	(2)	
18.	30, 35, 40, 45 <i>Half mark each</i>	(2)	
	TOTAL	50	