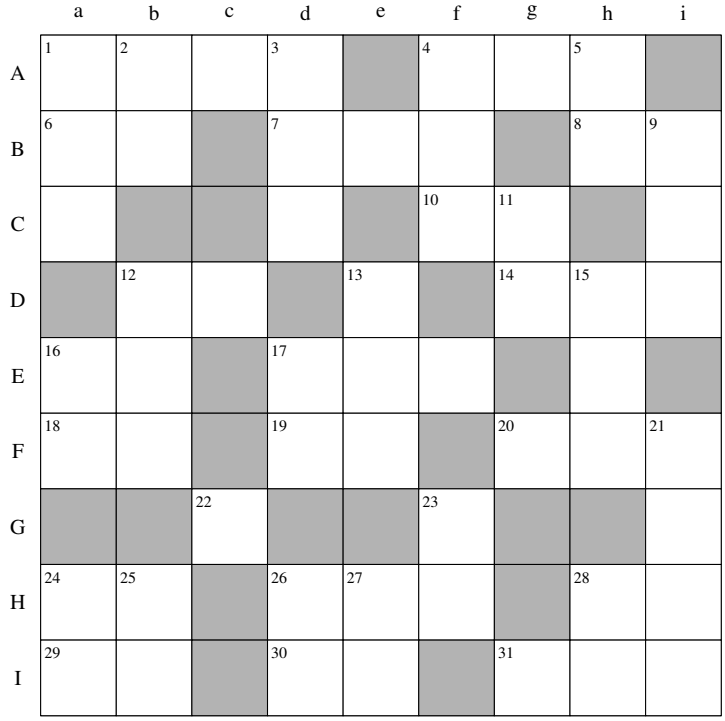
2012 ANU Maths Day Cross Contest



Across Clues

1 $1a$ and $1d$ give the same remainder when divided by 3, 5, 7, 9 or 11.

4 $2 \times 3^{12d-4a} = 3 \times 2^{12d-4a}$

6 $\displaystyle\int_0^{6a} 2x\,dx = \int_{29a}^{2d} 2x\,dx$

7 $7a + 16d = 3 \times 17d$
$7a + 17d = 3 \times 16d$

8 $\sin(8a) = \cos(22a)$

10 $10a = 1 + 2 + \cdots + 27d$

12 $12a = 2 + 4 + \cdots + 28d$

14 see $28a$

16 $4^{9d} = 2^{16a} \times 2^{17a}$

17 see $16a$

18 $13d = 5 + 10 + \cdots + 18a$

19 $6^{19a} = 2^{30a} \times 3^{16a}$

20 $20a = (\frac{3}{4} + (\frac{3}{4})^2 + \cdots) \times 15d$

22 see $8a, 28a$

24 $(24a - 5d) \times 4 = (5d - 25d) \times 3$
$24a > 5d > 25d$

26 $26a, 23d$ and $26d$ can be arranged to form an increasing AP.

28 $2^{28a} = 14a \times 22a$

29 $2d = 29a + 1$

30 see $19a$

31 $\tan(31a) = 1$

A.P. = arithmetic progression, eg. 7, 11, 15, 19, . . .

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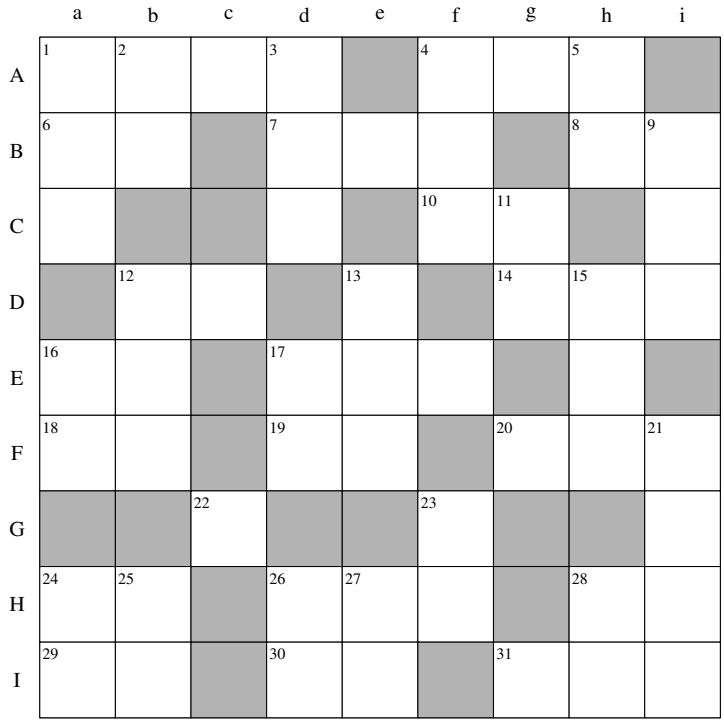

Down Clues

1 $1a$ and $1d$ give the same remainder when divided by 3, 5, 7, 9 or 11.

2 $\int_0^{6a} 2x\,dx = \int_{29a}^{2d} 2x\,dx$
$2d = 29a + 1$

3 A Fibonacci number

4 $\tan(4d) = 1$

5 $(24a - 5d) \times 4 = (5d - 25d) \times 3$
$24a > 5d > 25d$

9 $4^{9d} = 2^{16a} \times 2^{17a}$

11 A triangular number

12 $2 \times 3^{12d-4a} = 3 \times 2^{12d-4a}$

13 $13d = 5 + 10 + \cdots + 18a$

15 $20a = (\frac{3}{4} + (\frac{3}{4})^2 + \cdots) \times 15d$

16 $7a + 16d = 3 \times 17d$
$7a + 17d = 3 \times 16d$

17 see $16d, 21d$

21 $21d = (17d)^2$

22 $2^{28a} = 22d \times 14a$

23 $26a, 23d$ and $26d$ can be arranged to form an increasing AP.

24 $\sin(1a - 24d) = 0.5$

25 see $5d$

26 see $23d$

27 $10a = 1 + 2 + \cdots + 27d$

28 $12a = 2 + 4 + \cdots + 28d$

A.P. = arithmetic progression, eg. 7, 11, 15, 19, ...
Triangular numbers are 1, 3, 6, 10, 15, 21, ...
Fibonacci numbers are 1, 1, 2, 3, 5, 8, 13, 21, ...

Across Guide

when you have	you can get
-	Ii
Cf	Cg, He-Ie
Fd, Ie	Ea-Eb, Fe, Id
Dg, Hi	Dh-Di, Gc, Hh
Ea, Fd	Bd-Bf, Ed, Fa
Fa, Fe	De-Ee, Fb
Di, Ea-Eb, Ed-Ee	Bi-Ci, Ef
Af, Eb-Fb	Ag-Ah, Db
Bi, Gc	Bh
Ih-Ii	Ig
Ib	Ab-Bb, Ba-Bb, Ia
He, Id	Gf, Hd, Hf
Ab, Ad, Ba	Aa, Ac, Ca

Down Guide

when you have	you can get
-	Cf
Ii	Fd, Hi
Cg	Dg
Dg, Hi	Dh-Di, Gc, Hh
Ea, Fd	Bd-Bf, Ed, Fa
Ed-Fd	Fi-Gi
Bf-Cf	Af
Dh, Fi	Eh-Fh, Fg-Fh
Db, Hh	Dc, Ih
Ah-Bh	Ha-Hb, Hb-Ib
Ib	Ab-Bb, Ba-Bb, Ia
Bd	Ad, Cd
Ab, Ad, Ba	Aa, Ac, Ca

Solution

	a	b	c	d	e	f	g	h	i
A	7	6	4	6		4	0	4	
B	1	1		1	1	0		8	2
C	6			0		5	5		9
D		4	2		3		5	1	2
E	5	0		5	3	4		7	
F	5	5		5	0		5	1	3
G			8			6			0
H	5	4		1	1	5		1	2
I	6	0		5	0		2	2	5