LIFETIME LEARNING

BY MONSIGNOR ANDY VARGA   *SPECIAL SUPPLEMENT*

CALCULATING THE DATE OF EASTER

Reference Website: http://aa.usno.navy.mil/AA/faq/docs/easter.html
See also: http://aa.usno.navy.mil/AA/data/docs/easter.html

Many people wonder how the date for Easter is determined. It's a bit more complicated than simply saying that Easter occurs on the first Sunday following the first full moon of spring.

The Council of Nicaea in 325 AD declared that Easter would fall on the first Sunday after the full moon which occurs on or closest after March 21. By that declaration, the Council in effect set March 21 as the "permanent" date for the first day of Spring, whether the vernal equinox actually occurs on that date or not! The date of Easter is derived from mathematical tables based on March 21 as a fixed date for the first day of Spring; those tables yield a date for what is called the "ecclesiastical" full moon, not always identical to the date of the real first full moon of Spring. In other words, on very rare occasions, this ecclesiastical full moon can occur on the last day of winter, forcing the date of Easter to be extremely early. If this ecclesiastical full moon occurs on a Sunday, the date of Easter is set for the following Sunday. Based on these tables, Easter can occur as early as March 22 or as late as April 25. *(**Try the calculations below or on the reverse page for the years 2008 and 2011 !!**)*

You can read more about it by consulting the website addresses listed above. For do-it-yourselfers, the formulas you need to calculate the date of Easter for any year are also found on that website and reproduced below; this algorithm was derived by J.-M. Oudin in 1940. (Trust me: it is a great improvement on the formulas devised by a mathematician named Gauss in 1800!) For the "computerly-curious," I've converted these formulas to MS *Excel* spreadsheet functions and derived an additional function for calculating the date of Ash Wednesday; you can find these on the reverse of this sheet. ***Happy Easter!!***

NOTES: * *indicates multiplication   and   / indicates division*
     All the variables are integers and any remainders from division are dropped

Y = the year for which you want to know the date of Easter

$C = Y / 100$

$N = Y - [19 * (Y / 19)]$

$K = (C - 17) / 25$

$I_A = C - (C / 4) - [(C - K) / 3] - (19 * N) + 15$

$I_B = I_A - [30 * (I_A / 30)]$

$I_C = I_B - \{ [I_B / 28] * [1 - (I_B / 28)] * [29 / (I_B + 1)] * [(21 - N) / 11] \}$

$J_A = Y + (Y / 4) + I_C + 2 - C + (C / 4)$

$J_B = J_A - [7 * (J_A / 7)]$

$L = I_C - J_B$

$M = 3 + [(L + 40) / 44]$ *(Yields the month in which Easter will occur for year Y)*

$D = (L + 28) - [31 * (M / 4)]$ *(Yields the day on which Easter will occur for year Y)*

over…

CALCULATING THE DATE OF EASTER AND ASH WEDNESDAY: CONVERSION TO (*Microsoft Excel*) SPREADSHEET FUNCTIONS

Label the cells A1 through N1 as follows
(Variables C, N, K, I_a, etc., correspond to those given in the equations on the previous page):

A1   YEAR
B1   Ash Wednesday
C1   EASTER
D1   C
E1   N
F1   K
G1 I_A
H1 I_B
I1 I_C
J1 J_A
K1 J_B
L1   L
M1   M
N1   D

Into the following cells, copy these functions EXACTLY as they appear (AND in the order given below to avoid illegal reference problems):

D2   =INT(A2/100)
E2   =A2-(19*(INT(A2/19)))
F2   =INT((D2-17)/25)
G2   =D2-(INT(D2/4))-(INT((D2-F2)/3))+(19*E2)+15
H2   =(G2-(30*(INT(G2/30))))
I2   =H2-(INT(H2/28))*(1-(INT(H2/28))*(INT(29/(H2+1)))*(INT((21-E2)/11)))
J2   =A2+(INT(A2/4))+I2+2-D2+(INT(D2/4))
K2   =J2-(7*(INT(J2/7)))
L2   =I2-K2
M2   =SUM(3+INT((L2+40)/44))
N2   =(L2+28)-(31*(INT(M2/4)))
C2   =DATE(A2,M2,N2)
B2   =N(C2)-46

Type into cell A2 the year for which you want to calculate the date of Ash Wednesday and Easter.
The resulting date for Ash Wednesday that year will appear in cell B2.
The resulting date for Easter that year will appear in cell C2.

Challenge: Using the function in Cell B2 as a model, can you construct additional functions to calculate the dates of Ascension and Pentecost? Check your answers against the calendar!