First paragraphs needs some wordsmithing – it's essentially the introduction and solution slides that Gareth and I came up with.

ISO/IEC 29500's usage of ISO 8601 gives no guidance as to:

- Date/time entities covered
- Treatment of time zones
- Precision
- Lexical representations permitted
- Treatment of dates and times at runtime
- Function prototypes are currently at odds with wording

To amend this, we propose the following broad changes:

- Change date range from [-9999, 9999] to [0001, 9999]
- Define specific lexical representations for date, time and dateTime values
- Change date/times from UTC to local
- Prescribe use of serial dates in formulas
- Define exact method for translating serial to ISO 8601

These will be effected via the following changes to the standard:

To Part 1, 18.3.1.96: v (Cell Value):

> This element expresses the value contained in a cell. If the cell contains a string, then this value is an index into the shared string table, pointing to the actual string value. Otherwise, the value of the cell is expressed directly in this element. Cells containing formulas express the last calculated result of the formula in this element.
>
> For applications not wanting to implement the shared string table, an 'inline string' can be expressed in an <is> element under <c> (instead of a <v> element under <c>),in the same way a string would be expressed in the shared string table. [*Note*: See <is> for an example. *end note*]
>
> [*Example*: In this example cell B4 contains the number "360" and C4 contains the ~~UTC~~ local date 22 November 1976, 08:30.
>
> ```
> <c r="B4">
>   <v>360</v>
> </c>
> <c r="C4" t="d">
>   <v>1976-11-22T08:30~~Z~~</v>
> </c>
> ```

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end example]

To Part 1, 18.17.4: Dates and Times:

Each unique instant in SpreadsheetML time is stored as an ISO 8601-formatted string, which is made up of a date component, a time component, and a timezone component. The earliest date permitted is 0001-01-01, 00:00 (midnight on the first of January, in the year 1). The latest date permitted is 9999-12-31, 23:59:59.

Values with only a date component shall be stored using the Complete, Extended Format Calendar Date format, as defined in [reference to ISO 8601, B.1.1 and B2.1].

[*Example*: The date 22 November 1976 would be represented in the following way within SpreadsheetML:

1976-11-22
end example]

Values with only a time component shall be stored using the Complete, Extended Format Time Of Day format, as defined in [reference to ISO 8601, B.1.2 and B2.2]. The decimal separator shall be a full stop (period) and decimal places shall be limited to 3.

[*Example*: The time 08:30 could be represented in the following ways within SpreadsheetML:

08:30
08:30.00
end example]

Values with both date and time components shall be stored using the Complete, Extended Format Calendar Date and Time Of Day format, as defined in [reference to ISO 8601, B.1.3 and B2.3]. For the time component, the decimal separator shall be a full stop (period) and decimal places shall be limited to 3.

[*Example*: The date 22 November 1976 at time 08:30 could be represented in the following ways within SpreadsheetML:

1976-11-22T08:30
1976-11-22T08:30.00
end example]

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Numerous functions take dates and/or times as arguments. Functions that care only about the date shall ignore any time information that is provided. Functions that care only about the time shall ignore any date information that is provided.

~~[*Example*: The date 22 November 1976 at exactly 08:30 Pacific Standard Time (+08:00 UTC) could be represented in the following (non-exhaustive list of) ways within SpreadsheetML:~~

~~1976-11-22T08:30:00,000+08:00~~
~~1976-11-22T16:30Z~~
~~*end example*]~~

~~For compatibility with existing spreadsheet applications, a consuming application should allow certain numeric serial values to be interpreted as dates and times for display or for use in calculations~~When used in calculations, dates and times are converted to serial values. These values should behave as defined in §**Error! Reference source not found.**, §**Error! Reference urce not found.**, and §**Error! Reference source not found.**.

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To Part 1, 18.17.4.1 Date Conversion for Serial Values:

~~All date values stored in cells within a SpreadsheetML file are stored in the ISO 8601 format.~~

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Comment [A9]: This is already mentioned in 18.17.6.7

~~For compatibility, a SpreadsheetML application can interpret serial number values in cells or in formulas as dates. This subclause describes how serial number values can be converted to date values depending on the compatibility mode.~~

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Comment [A11]: This means that, in strict at least, dates and times cannot be serial values in cells.

See note below about part 4.

A date that can be interpreted as a numeric value is a *serial value*. This is made up of a signed integer date component and an unsigned fractional time component. Going forward in time, the date component of a serial value increases by 1 each day. A serial value represents a ~~UTC~~ local date and time, and, as such, has no timezone information.

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Three different bases can be used for converting dates into serial values:

- In the *1900 date base system*, the lower limit is January 1, ~~-9999~~0001 00:00:00, which has serial value -4346018. The upper-limit is December 31, 9999, 23:59:59, which has serial value 2,958,465.9999884. The base date for this date base system is December 30, 1899, which has a serial value of 0.
- In the *1900 backward compatibility date-base system*, the lower limit is January 1, 1900, 00:00:00, which has serial value 1. The upper limit is December 31, 9999, 23:59:59, which has serial value 2,958,465.9999884. The base date for this date base system is December 31, 1899, which has a serial value of 0.
- In the *1904 backward compatibility date-base system*, the lower limit is January 1, 1904, 00:00:00, which has serial value 0. The upper limit is December 31, 9999, 23:59:59,

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which has serial value 2,957,003.9999884. The base date for this date base system is January 1, 1904, which has a serial value of 0.

To Part 1, 18.17.4.3 Combined Date and Time Conversion for Serial Values

Any date component can be added to any time component to produce a serial value for that date/time combination. The resulting serial value encodes that date whose (positive or negative) time span from base date in the respective date-base equals the serial value.

[*Note*: In the 1900 date base system, the serial value -1.25 represents December 28, 1899, 18:00. *end note*]

[*Example*: For the 1900 date base system:

The serial value -2337.999989… represents 1893-08-05T00:00:01~~Z~~
The serial value `3687.4207639`… represents 1910-02-03T10:05:54~~Z~~
The serial value `1.5000000`… represents 1900-01-01T12:00:00~~Z~~
The serial value `2958465.9999884`… represents 9999-12-31T23:59:59~~Z~~

For the 1904 backward compatibility date base system:

The serial value -3799.999989… represents 1893-08-05T00:00:01~~Z~~
The serial value `2225.4207639`… represents 1910-02-03T10:05:54~~Z~~
The serial value `0.5000000`… represents 1904-01-01T12:00:00~~Z~~
The serial value `2957003.9999884`… represents 9999-12-31T23:59:59~~Z~~

end example]

To Part 1, 18.17.6.7 Dates and Times

A date and/or time in a cell is stored as an ISO 8601 string.

To Part 1, 18.17.7.74 DATE

Arguments:

Name	Type	Description
year	number	A positive number, truncated to an integer representing the year, that together with *month* and *day* specifies the date whose serial value is to be computed. For the 1900 date base system: • If *year* is in the range 0–99, inclusive, the year shall be interpreted as *year* + 1900. • If *year* is in the range ~~-9999–-1, inclusive, or~~ 100–

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Name	Type	Description
		9999, inclusive, the year shall be interpreted as *year*. For the 1900 backward compatibility date-base and 1904 backward compatibility date base systems: • If *year* is in the range 0–1899, inclusive, the year shall be interpreted as *year* + 1900. • If *year* is in the range 1900–9999, inclusive, the year shall be interpreted as *year*.

To Part 1, section M:

There are two areas of this section with copy-pasted text from sections above (M.2.16.9.1; M.2.16.9.3). They also need to be updated.

To Part 4:

We need some text added (somewhere) to say that dates and times *can* be persisted as serial values. This doesn't fit into the normal organization of Part 4, so we'll have to think of somewhere to put it (Rex suggested that I just leave this as a TBD).