

Modul:ConvertNumeric

Usage

```
{{#invoke:ConvertNumeric|function_name}}
```

See also

- **Vorlage:TI**
- **Vorlage:TI**
- **Module:StripToNumbers** - extract a number from a string (supports negatives and decimals) and return it, or optionally return a halved value

```
-- Module for converting between different representations of numbers. See talk p
-- For unit tests see: [[Module:ConvertNumeric/testcases]]
-- When editing, preview with: [[Module_talk:ConvertNumeric/testcases]]
-- First, edit [[Module:ConvertNumeric/sandbox]], then preview with [[Module_talk
```

```
local ones_position = {
    [0] = 'zero',
    [1] = 'one',
    [2] = 'two',
    [3] = 'three',
    [4] = 'four',
    [5] = 'five',
    [6] = 'six',
    [7] = 'seven',
    [8] = 'eight',
    [9] = 'nine',
    [10] = 'ten',
    [11] = 'eleven',
    [12] = 'twelve',
    [13] = 'thirteen',
    [14] = 'fourteen',
    [15] = 'fifteen',
    [16] = 'sixteen',
    [17] = 'seventeen',
    [18] = 'eighteen',
    [19] = 'nineteen'
}
```

```
local ones_position_ord = {
    [0] = 'zeroth',
    [1] = 'first',
    [2] = 'second',
    [3] = 'third',
    [4] = 'fourth',
    [5] = 'fifth',
    [6] = 'sixth',
    [7] = 'seventh',
    [8] = 'eighth',
    [9] = 'ninth',
    [10] = 'tenth',
}
```

```
[11] = 'eleventh',
[12] = 'twelfth',
[13] = 'thirteenth',
[14] = 'fourteenth',
[15] = 'fifteenth',
[16] = 'sixteenth',
[17] = 'seventeenth',
[18] = 'eighteenth',
[19] = 'nineteenth'
}

local ones_position_plural = {
    [0] = 'zeros',
    [1] = 'ones',
    [2] = 'twos',
    [3] = 'threes',
    [4] = 'fours',
    [5] = 'fives',
    [6] = 'sixes',
    [7] = 'sevens',
    [8] = 'eights',
    [9] = 'nines',
    [10] = 'tens',
    [11] = 'elevens',
    [12] = 'twelves',
    [13] = 'thirteens',
    [14] = 'fourteens',
    [15] = 'fifteens',
    [16] = 'sixteens',
    [17] = 'seventeens',
    [18] = 'eighteens',
    [19] = 'nineteens'
}

local tens_position = {
    [2] = 'twenty',
    [3] = 'thirty',
    [4] = 'forty',
    [5] = 'fifty',
    [6] = 'sixty',
    [7] = 'seventy',
    [8] = 'eighty',
    [9] = 'ninety'
}

local tens_position_ord = {
    [2] = 'twentieth',
    [3] = 'thirtieth',
    [4] = 'fortieth',
    [5] = 'fiftieth',
    [6] = 'sixtieth',
    [7] = 'seventieth',
    [8] = 'eightieth',
    [9] = 'ninetieth'
}

local tens_position_plural = {
    [2] = 'twenties',
    [3] = 'thirties',
    [4] = 'forties',
    [5] = 'fifties',
    [6] = 'sixties',
    [7] = 'seventies',
    [8] = 'eighties',
```

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        [9] = 'nineties'
    }

    local groups = {
        [1] = 'thousand',
        [2] = 'million',
        [3] = 'billion',
        [4] = 'trillion',
        [5] = 'quadrillion',
        [6] = 'quintillion',
        [7] = 'sextillion',
        [8] = 'septillion',
        [9] = 'octillion',
        [10] = 'nonillion',
        [11] = 'decillion',
        [12] = 'undecillion',
        [13] = 'duodecillion',
        [14] = 'tredecillion',
        [15] = 'quattuordecillion',
        [16] = 'quindecillion',
        [17] = 'sexdecillion',
        [18] = 'septendecillion',
        [19] = 'octodecillion',
        [20] = 'novemdecillion',
        [21] = 'vigintillion',
        [22] = 'unvigintillion',
        [23] = 'duovigintillion',
        [24] = 'tresvigintillion',
        [25] = 'quattuorvigintillion',
        [26] = 'quinvigintillion',
        [27] = 'sevivigintillion',
        [28] = 'septemvigintillion',
        [29] = 'octovigintillion',
        [30] = 'novemvigintillion',
        [31] = 'trigintillion',
        [32] = 'untrigintillion',
        [33] = 'duotrigintillion',
        [34] = 'trestrigintillion',
        [35] = 'quattuortrigintillion',
        [36] = 'quinqutrigintillion',
        [37] = 'sestrigintillion',
        [38] = 'septentrigintillion',
        [39] = 'octotrigintillion',
        [40] = 'noventrigintillion',
        [41] = 'quadragintillion',
        [51] = 'quinguagintillion',
        [61] = 'sexagintillion',
        [71] = 'septuagintillion',
        [81] = 'octogintillion',
        [91] = 'nonagintillion',
        [101] = 'centillion',
        [102] = 'uncentillion',
        [103] = 'duocentillion',
        [104] = 'trescentillion',
        [111] = 'decicentillion',
        [112] = 'undecicentillion',
        [121] = 'viginticentillion',
        [122] = 'unviginticentillion',
        [131] = 'trigintacentillion',
        [141] = 'quadragintacentillion',
        [151] = 'quinguagintacentillion',
        [161] = 'sexagintacentillion',
        [171] = 'septuagintacentillion',
        [181] = 'octogintacentillion',
```

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        [191] = 'nonagintacentillion',
        [201] = 'ducentillion',
        [301] = 'trecentillion',
        [401] = 'quadrilingentillion',
        [501] = 'quingentillion',
        [601] = 'sescentillion',
        [701] = 'septingentillion',
        [801] = 'octingentillion',
        [901] = 'nongentillion',
        [1001] = 'millinillion',
    }

    local roman_numerals = {
        I = 1,
        V = 5,
        X = 10,
        L = 50,
        C = 100,
        D = 500,
        M = 1000
    }

    local engord_tens_end = {
        ['twentieth'] = 20,
        ['thirtieth'] = 30,
        ['fortieth'] = 40,
        ['fiftieth'] = 50,
        ['sixtieth'] = 60,
        ['seventieth'] = 70,
        ['eightieth'] = 80,
        ['ninetieth'] = 90,
    }

    local eng_tens_cont = {
        ['twenty'] = 20,
        ['thirty'] = 30,
        ['forty'] = 40,
        ['fifty'] = 50,
        ['sixty'] = 60,
        ['seventy'] = 70,
        ['eighty'] = 80,
        ['ninety'] = 90,
    }

    -- Converts a given valid roman numeral (and some invalid roman numerals) to a number
    local function roman_to_numeral(roman)
        if type(roman) ~= "string" then return -1, "roman numeral not a string" end
        local rev = roman:reverse()
        local raising = true
        local last = 0
        local result = 0
        for i = 1, #rev do
            local c = rev:sub(i, i)
            local next = roman_numerals[c]
            if next == nil then return -1, "roman numeral contains illegal character" end
            if next > last then
                result = result + next
                raising = true
            elseif next < last then
                result = result - next
                raising = false
            elseif raising then
                result = result + next
            else
                result = result - next
            end
            last = next
        end
        return result
    end

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        result = result - next
    end
    last = next
end
return result
end

-- Converts a given integer between 0 and 100 to English text (e.g. 47 -> forty-
local function numeral_to_english_less_100(num, ordinal, plural, zero)
    local terminal_ones, terminal_tens
    if ordinal then
        terminal_ones = ones_position_ord
        terminal_tens = tens_position_ord
    elseif plural then
        terminal_ones = ones_position_plural
        terminal_tens = tens_position_plural
    else
        terminal_ones = ones_position
        terminal_tens = tens_position
    end

    if num == 0 and zero ~= nil then
        return zero
    elseif num < 20 then
        return terminal_ones[num]
    elseif num % 10 == 0 then
        return terminal_tens[num / 10]
    else
        return tens_position[math.floor(num / 10)] .. '-' .. terminal_ones[num % 10]
    end
end

local function standard_suffix(ordinal, plural)
    if ordinal then return 'th' end
    if plural then return 's' end
    return ''
end

-- Converts a given integer (in string form) between 0 and 1000 to English text
local function numeral_to_english_less_1000(num, use_and, ordinal, plural, zero)
    num = tonumber(num)
    if num < 100 then
        return numeral_to_english_less_100(num, ordinal, plural, zero)
    elseif num % 100 == 0 then
        return ones_position[num/100] .. ' hundred' .. standard_suffix(ordinal, plural)
    else
        return ones_position[math.floor(num/100)] .. ' hundred ' .. (use_and and 'and ' or '') .. numeral_to_english_less_100(num % 100, ordinal, plural, zero)
    end
end

-- Converts an ordinal in English text from 'zeroth' to 'ninety-ninth' inclusive
local function english_to_ordinal(english)
    local eng = string.lower(english or '')

    local engord_lt20 = {} -- ones_position_ord{} keys & values swapped
    for k, v in pairs(ones_position_ord) do
        engord_lt20[v] = k
    end

    if engord_lt20[eng] then
        return engord_lt20[eng] -- e.g. first -> 1
    elseif engord_tens_end[eng] then
        return engord_tens_end[eng] -- e.g. ninetieth -> 90
    else
        return nil
    end
end

```

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        local tens, ones = string.match(eng, '^[a-z+][%s%-]+([a-z+])$')
        if tens and ones then
            local tens_cont = eng_tens_cont[tens]
            local ones_end = eng_lt20[ones]
            if tens_cont and ones_end then
                return tens_cont + ones_end -- e.g. ninety-ninth
            end
        end
    end
end
return -1 -- Failed
end

-- Converts a number in English text from 'zero' to 'ninety-nine' inclusive to a
local function english_to_numeral(english)
    local eng = string.lower(english or '')

    local eng_lt20 = { ['single'] = 1 } -- ones_position{} keys & values swapped
    for k, v in pairs(ones_position) do
        eng_lt20[v] = k
    end

    if eng_lt20[eng] then
        return eng_lt20[eng] -- e.g. one -> 1
    elseif eng_tens_cont[eng] then
        return eng_tens_cont[eng] -- e.g. ninety -> 90
    else
        local tens, ones = string.match(eng, '^[a-z+][%s%-]+([a-z+])$')
        if tens and ones then
            local tens_cont = eng_tens_cont[tens]
            local ones_end = eng_lt20[ones]
            if tens_cont and ones_end then
                return tens_cont + ones_end -- e.g. ninety-nine
            end
        end
    end
    return -1 -- Failed
end

-- Converts a number expressed as a string in scientific notation to a string in
-- e.g. 1.23E5 -> 123000, 1.23E-5 = .0000123. Conversion is exact, no rounding is
local function scientific_notation_to_decimal(num)
    local exponent, subs = num:gsub("^%-?%d*%.[%d%-]?[Ee]([%+%-]?%d+)$", "%1")
    if subs == 0 then return num end -- Input not in scientific notation, just
    exponent = tonumber(exponent)

    local negative = num:find("^%-")
    local _, decimal_pos = num:find("%.")
    -- Mantissa will consist of all decimal digits with no decimal point
    local mantissa = num:gsub("^%-?(%d*)%.[%d%-]?[Ee]([%+%-]?%d+)$", "%1%2")
    if negative and decimal_pos then decimal_pos = decimal_pos - 1 end
    if not decimal_pos then decimal_pos = #mantissa + 1 end

    -- Remove leading zeros unless decimal point is in first position
    while decimal_pos > 1 and mantissa:sub(1,1) == '0' do
        mantissa = mantissa:sub(2)
        decimal_pos = decimal_pos - 1
    end

    -- Shift decimal point right for exponent > 0
    while exponent > 0 do
        decimal_pos = decimal_pos + 1
        exponent = exponent - 1
        if decimal_pos > #mantissa + 1 then mantissa = mantissa .. '0' end
        -- Remove leading zeros unless decimal point is in first position
        while decimal_pos > 1 and mantissa:sub(1,1) == '0' do

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        mantissa = mantissa:sub(2)
        decimal_pos = decimal_pos - 1
    end
end
-- Shift decimal point left for exponent < 0
while exponent < 0 do
    if decimal_pos == 1 then
        mantissa = '0' .. mantissa
    else
        decimal_pos = decimal_pos - 1
    end
    exponent = exponent + 1
end

-- Insert decimal point in correct position and return
return (negative and '-' or '') .. mantissa:sub(1, decimal_pos - 1) .. '
end

-- Rounds a number to the nearest integer (NOT USED)
local function round_num(x)
    if x%1 >= 0.5 then
        return math.ceil(x)
    else
        return math.floor(x)
    end
end

-- Rounds a number to the nearest two-word number (round = up, down, or "on" for
-- Numbers with two digits before the decimal will be rounded to an integer as sp
-- Larger numbers will be rounded to a number with only one nonzero digit in front
-- Negative sign is preserved and does not count towards word limit.
local function round_for_english(num, round)
    -- If an integer with at most two digits, just return
    if num:find("^%-%d?%d%.?$") then return num end

    local negative = num:find("^%-")
    if negative then
        -- We're rounding magnitude so flip it
        if round == 'up' then round = 'down' elseif round == 'down' then
    end

    -- If at most two digits before decimal, round to integer and return
    local _, _, small_int, trailing_digits, round_digit = num:find("^%-%d?(%d?)")
    if small_int then
        if small_int == '' then small_int = '0' end
        if (round == 'up' and trailing_digits:find('[1-9]')) or (round ==
            small_int = tostring(tonumber(small_int) + 1)
        end
        return (negative and '-' or '') .. small_int
    end

    -- When rounding up, any number with > 1 nonzero digit will round up (e.g
    local nonzero_digits = 0
    for digit in num:gfind("[1-9]") do
        nonzero_digits = nonzero_digits + 1
    end

    num = num:gsub("%.%d*$", "") -- Remove decimal part
    -- Second digit used to determine which way to round lead digit
    local _, _, lead_digit, round_digit, round_digit_2, rest = num:find("^%-%d?(%d?)")
    if tonumber(lead_digit .. round_digit) < 20 and (1 + #rest) % 3 == 0 then
        -- In English numbers < 20 are one word so put 2 digits in lead a
        lead_digit = lead_digit .. round_digit
        round_digit = round_digit_2
    end
end

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        else
            rest = round_digit_2 .. rest
        end

        if (round == 'up' and nonzero_digits > 1) or (round == 'on' and tonumber(
            lead_digit = tostring(tonumber(lead_digit) + 1)
        end
        -- All digits but lead digit will turn to zero
        rest = rest:gsub("%d", "0")
        return (negative and '-' or '') .. lead_digit .. '0' .. rest
    end

    local denominators = {
        [2] = { 'half', plural = 'halves' },
        [3] = { 'third' },
        [4] = { 'quarter', us = 'fourth' },
        [5] = { 'fifth' },
        [6] = { 'sixth' },
        [8] = { 'eighth' },
        [9] = { 'ninth' },
        [10] = { 'tenth' },
        [16] = { 'sixteenth' },
    }

    -- Return status, fraction where:
    -- status is a string:
    --     "finished" if there is a fraction with no whole number;
    --     "ok" if fraction is empty or valid;
    --     "unsupported" if bad fraction;
    -- fraction is a string giving (numerator / denominator) as English text, or is '
    -- Only unsigned fractions with a very limited range of values are supported,
    -- except that if whole is empty, the numerator can use "-" to indicate negative
    -- whole (string or nil): nil or "" if no number before the fraction
    -- numerator (string or nil): numerator, if any (default = 1 if a denominator is
    -- denominator (string or nil): denominator, if any
    -- sp_us (boolean): true if sp=us
    -- negative_word (string): word to use for negative sign, if whole is empty
    -- use_one (boolean): false: 2+1/2 → "two and a half"; true: "two and one-half"
    local function fraction_to_english(whole, numerator, denominator, sp_us, negative
        if numerator or denominator then
            local finished = (whole == nil or whole == '')
            local sign = ''
            if numerator then
                if finished and numerator:sub(1, 1) == '-' then
                    numerator = numerator:sub(2)
                    sign = negative_word .. ' '
                end
            end
            else
                numerator = '1'
            end
            if not numerator:match('^%d+$') or not denominator or not denomi
                return 'unsupported', ''
            end
            numerator = tonumber(numerator)
            denominator = tonumber(denominator)
            local dendata = denominators[denominator]
            if not (dendata and 1 <= numerator and numerator <= 99) then
                return 'unsupported', ''
            end
            local numstr, denstr
            local sep = '-'
            if numerator == 1 then
                denstr = sp_us and dendata.us or dendata[1]
                if finished or use_one then

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        numstr = 'one'
    elseif denstr:match('^[aeiou]') then
        numstr = 'an'
        sep = ' '
    else
        numstr = 'a'
        sep = ' '
    end
end
else
    numstr = numeral_to_english_less_100(numerator)
    denstr = dendata.plural
    if not denstr then
        denstr = (sp_us and dendata.us or dendata[1]) ..
    end
end
end
if finished then
    return 'finished', sign .. numstr .. sep .. denstr
end
return 'ok', ' and ' .. numstr .. sep .. denstr
end
return 'ok', ''
end

-- Takes a decimal number and converts it to English text.
-- Return nil if a fraction cannot be converted (only some numbers are supported)
-- num (string or nil): the number to convert.
--     Can be an arbitrarily large decimal, such as "-123456789123456789.345", and
--     can use scientific notation (e.g. "1.23E5").
--     May fail for very large numbers not listed in "groups" such as "1E4000".
--     num is nil if there is no whole number before a fraction.
-- numerator (string or nil): numerator of fraction (nil if no fraction)
-- denominator (string or nil): denominator of fraction (nil if no fraction)
-- capitalize (boolean): whether to capitalize the result (e.g. 'One' instead of 'one')
-- use_and (boolean): whether to use the word 'and' between tens/ones place and fraction
-- hyphenate (boolean): whether to hyphenate all words in the result, useful as a
-- ordinal (boolean): whether to produce an ordinal (e.g. 'first' instead of 'one')
-- plural (boolean): whether to pluralize the resulting number
-- links: nil: do not add any links; 'on': link "billion" and larger to Orders of
--     any other text: list of numbers to link (e.g. "billion,quadrillion")
-- negative_word: word to use for negative sign (typically 'negative' or 'minus')
-- round: nil or '': no rounding; 'on': round to nearest two-word number; 'up'/'down':
-- zero: word to use for value '0' (nil to use default)
-- use_one (boolean): false: 2+1/2 → "two and a half"; true: "two and one-half"
local function numeral_to_english(num, numerator, denominator, capitalize, use_and,
    if not negative_word then
        if use_and then
            -- TODO Should 'minus' be used when do not have sp=us?
            --     If so, need to update testcases, and need to fix
            -- negative_word = 'minus'
            negative_word = 'negative'
        else
            negative_word = 'negative'
        end
    end
end
local status, fraction_text = fraction_to_english(num, numerator, denominator)
if status == 'unsupported' then
    return nil
end
if status == 'finished' then
    -- Input is a fraction with no whole number.
    -- Hack to avoid executing stuff that depends on num being a number
    local s = fraction_text
    if hyphenate then s = s:gsub("%s", "-") end
    if capitalize then s = s:gsub("^%l", string.upper) end

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        return s
    end
    num = scientific_notation_to_decimal(num)
    if round and round ~= '' then
        if round ~= 'on' and round ~= 'up' and round ~= 'down' then
            error("Invalid rounding mode")
        end
        num = round_for_english(num, round)
    end

    -- Separate into negative sign, num (digits before decimal), decimal_places
    local MINUS = '-' -- Unicode U+2212 MINUS SIGN (may be in values from [
    if num:sub(1, #MINUS) == MINUS then
        num = '-' .. num:sub(#MINUS + 1) -- replace MINUS with '-'
    elseif num:sub(1, 1) == '+' then
        num = num:sub(2) -- ignore any '+'
    end
    local negative = num:find("^%-")
    local decimal_places, subs = num:gsub("^%-?%d*%.(%d+)$", "%1")
    if subs == 0 then decimal_places = nil end
    num, subs = num:gsub("^%-?(%d*)%.?%d*$", "%1")
    if num == '' and decimal_places then num = '0' end
    if subs == 0 or num == '' then error("Invalid decimal numeral") end

    -- For each group of 3 digits except the last one, print with appropriate
    local s = ''
    while #num > 3 do
        if s ~= '' then s = s .. ' ' end
        local group_num = math.floor((#num - 1) / 3)
        local group = groups[group_num]
        local group_digits = #num - group_num*3
        s = s .. numeral_to_english_less_1000(num:sub(1, group_digits), t
        if links and (((links == 'on' and group_num >= 3) or links:find('
            s = s .. '[Orders_of_magnitude_(numbers)#10' .. group_num
        else
            s = s .. group
        end
        num = num:sub(1 + group_digits)
        num = num:gsub("^0*", "") -- Trim leading zeros
    end

    -- Handle final three digits of integer part
    if s ~= '' and num ~= '' then
        if #num <= 2 and use_and then
            s = s .. ' and '
        else
            s = s .. ' '
        end
    end

    if s == '' or num ~= '' then
        s = s .. numeral_to_english_less_1000(num, use_and, ordinal, plural)
    elseif ordinal or plural then
        -- Round numbers like "one million" take standard suffixes for ord
        s = s .. standard_suffix(ordinal, plural)
    end

    -- For decimal places (if any) output "point" followed by spelling out di
    if decimal_places then
        s = s .. ' point'
        for i = 1, #decimal_places do
            s = s .. ' ' .. ones_position[tonumber(decimal_places:sub
        end
    end
end

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    s = s:gsub("^%s*(.)%s*$", "%1") -- Trim whitespace
    if ordinal and plural then s = s .. 's' end -- s suffix works for all o
    if negative and s ~= zero then s = negative_word .. ' ' .. s end
    s = s:gsub("negative zero", "zero")
    s = s .. fraction_text
    if hyphenate then s = s:gsub("%s", "-") end
    if capitalize then s = s:gsub("^%l", string.upper) end
    return s
end

local function _numeral_to_english2(args)
    local num = args.num

    if (not tonumber(num)) then
        num = num:gsub("^%s*(.)%s*$", "%1") -- Trim whitespace
        num = num:gsub(",", "") -- Remove commas
        num = num:gsub("<span[^<>]*></span>", "") -- Generated by Template
        if num ~= '' then -- a fraction may have an empty whole number
            if not num:find("^%-?%d*%.[?%d*%-?[Ee]?[+%-]?%d*$") then
                -- Input not in a valid format, try to pass it th
                -- if that produces a number (e.g. "3 + 5" will k
                num = mw.getCurrentFrame():preprocess('{{#expr:
            end
        end
    end

    -- Pass args from frame to helper function
    return _numeral_to_english(
        num,
        args['numerator'],
        args['denominator'],
        args['capitalize'],
        args['use_and'],
        args['hyphenate'],
        args['ordinal'],
        args['plural'],
        args['links'],
        args['negative_word'],
        args['round'],
        args['zero'],
        args['use_one']
    ) or ''
end

local p = { -- Functions that can be called from another module
    roman_to_numeral = roman_to_numeral,
    spell_number = _numeral_to_english,
    spell_number2 = _numeral_to_english2,
    english_to_ordinal = english_to_ordinal,
    english_to_numeral = english_to_numeral,
}

function p._roman_to_numeral(frame) -- Callable via {{#invoke:ConvertNumeric|_rom
    return roman_to_numeral(frame.args[1])
end

function p._english_to_ordinal(frame) -- callable via {{#invoke:ConvertNumeric|_e
    return english_to_ordinal(frame.args[1])
end

function p._english_to_numeral(frame) -- callable via {{#invoke:ConvertNumeric|_e
    return english_to_numeral(frame.args[1])
end

```

```

function p.numeral_to_english(frame)
    local args = frame.args
    local num = args[1]
    num = num:gsub("^%s*(.)%s*$", "%1") -- Trim whitespace
    num = num:gsub(",", "") -- Remove commas
    num = num:gsub("^<span[^<]*></span>", "") -- Generated by Template:age
    if num ~= '' then -- a fraction may have an empty whole number
        if not num:find("^%-?%d*%.[?%d*%-?[Ee]?[+%-]?%d*$") then
            -- Input not in a valid format, try to pass it through #e
            -- if that produces a number (e.g. "3 + 5" will become "8
            num = frame:preprocess('{{#expr: ' .. num .. '}}')
        end
    end

    end

    -- Pass args from frame to helper function
    return _numeral_to_english(
        num,
        args['numerator'],
        args['denominator'],
        args['case'] == 'U' or args['case'] == 'u',
        args['sp'] ~= 'us',
        args['adj'] == 'on',
        args['ord'] == 'on',
        args['pl'] == 'on',
        args['lk'],
        args['negative'],
        args['round'],
        args['zero'],
        args['one'] == 'one' -- experiment: using '|one=one' makes fract
    ) or ''
end

---- recursive function for p.decToHex
local function decToHexDigit(dec)
    local dig = {"0","1","2","3","4","5","6","7","8","9","A","B","C","D","E",
    local div = math.floor(dec/16)
    local mod = dec-(16*div)
    if div >= 1 then return decToHexDigit(div)..dig[mod+1] else return dig[mod+1]
end -- I think this is supposed to be done with a tail call but first I want some

---- finds all the decimal numbers in the input text and hexes each of them
function p.decToHex(frame)
    local args=frame.args
    local parent=frame.getParent(frame)
    local pargs={}
    if parent then pargs=parent.args end
    local text=args[1] or pargs[1] or ""
    local minlength=args.minlength or pargs.minlength or 1
    minlength=tonumber(minlength)
    local prowl=mw.usttring.gmatch(text,"(.) (%d+)")
    local output=""
    repeat
        local chaff,dec=prowl()
        if not(dec) then break end
        local hex=decToHexDigit(dec)
        while (mw.usttring.len(hex)<minlength) do hex="0"..hex end
        output=output..chaff..hex
    until false
    local chaff=mw.usttring.match(text,"(%D+)$") or ""
    return output..chaff
end

return p

```

