Example 8 Importing and exporting Cadabra expressions

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{a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u#}::Indices(position=independent).

def create (file_name):
    import json, io, os, errno

    try:
        os.remove(file_name)                # delete the file if it exsists
        with open(file_name, 'w'): pass     # create an empty file
    except OSError as e:
        if e.errno == errno.ENOENT:         # errno.ENOENT = no such file or directory
           with open(file_name, 'w'): pass  # create an empty file
        else:
            raise                           # report an exception

    # Create and save an empty dict
    data_out = {}
    with io.open(os.getcwd() + '/' + file_name, 'w', encoding='utf-8') as out_file:
        out_file.write(json.dumps(data_out,
                                  indent=2,
                                  sort_keys=True,
                                  separators=(',', ': '),
                                  ensure_ascii=False)+'\n')

def put (key_name,object,file_name):
    import json, io, os

    # Read the current dict
    with io.open(os.getcwd() + '/' + file_name) as inp_file:
        data_out = json.load(inp_file)

    # Add a new entry to the dict
    data_out[key_name] = object.input_form()

    # Save the updated dict
    with io.open(os.getcwd() + '/' + file_name, 'w', encoding='utf-8') as out_file:
        out_file.write(json.dumps(data_out,
```

```
                                    indent=2,
                                    sort_keys=True,
                                    separators=(',', ': '),
                                    ensure_ascii=False)+'\n')

def get (key_name,file_name):
    import json, io, os

    # Read the current dict
    with io.open(os.getcwd() + '/' + file_name) as inp_file:
        data_inp = json.load(inp_file)

    # Return one entry from the dict
    return Ex (data_inp[key_name])

lib_name = 'example-08.json'

create (lib_name)

\nabla{#}::Derivative.

gab := g_{a b} - 1/3 x^{c} x^{d} R_{a c b d}
               - 1/6 x^{c} x^{d} x^{e} \nabla_{c}{R_{a d b e}}.                  # cdb (ex-08-02.101,gab)

iab := g^{a b} + 1/3 x^{c} x^{d} g^{a e} g^{b f} R_{c e d f}
               + 1/6 x^{c} x^{d} x^{e} g^{a f} g^{b g} \nabla_{c}{R_{d f e g}}.   # cdb (ex-08-02.102,iab)

put ('g_ab',gab,lib_name)
put ('g^ab',iab,lib_name)

foo = get ('g_ab',lib_name)                         # cdb (ex-08-02.103,foo)
bah = get ('g^ab',lib_name)                         # cdb (ex-08-02.104,bah)

tmp := @(gab) - @(foo).                             # cdb (ex-08-02.105,tmp)
tmp := @(iab) - @(bah).                             # cdb (ex-08-02.106,tmp)
```

$$g_{ab}(x) = g_{ab} - \frac{1}{3}x^c x^d R_{acbd} - \frac{1}{6}x^c x^d x^e \nabla_c R_{adbe} \tag{ex-08-02.101}$$

$$g^{ab}(x) = g^{ab} + \frac{1}{3}x^c x^d g^{ae} g^{bf} R_{cedf} + \frac{1}{6}x^c x^d x^e g^{af} g^{bg} \nabla_c R_{dfeg} \tag{ex-08-02.102}$$

$$\bar{g}_{ab}(x) = g_{ab} - \frac{1}{3}x^c x^d R_{acbd} - \frac{1}{6}x^c x^d x^e \nabla_c R_{adbe} \tag{ex-08-02.103}$$

$$\bar{g}^{ab}(x) = g^{ab} + \frac{1}{3}x^c x^d g^{ae} g^{bf} R_{cedf} + \frac{1}{6}x^c x^d x^e g^{af} g^{bg} \nabla_c R_{dfeg} \tag{ex-08-02.104}$$

$$g_{ab}(x) - \bar{g}_{ab}(x) = 0 \tag{ex-08-02.105}$$

$$g^{ab}(x) - \bar{g}^{ab}(x) = 0 \tag{ex-08-02.106}$$