# Latex Template

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# 1 Code

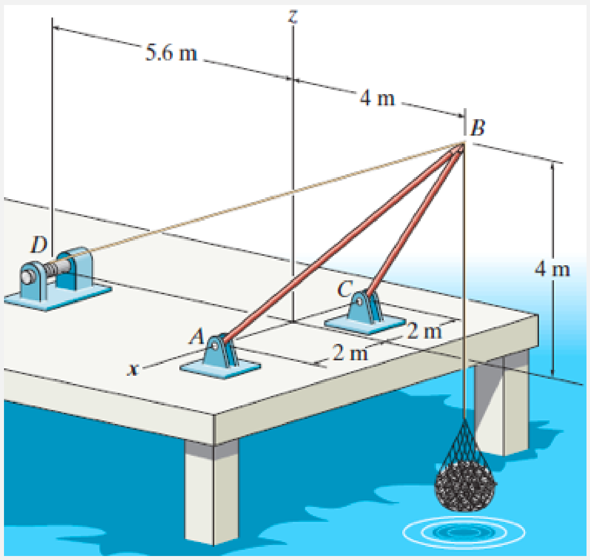
**My nice heading**

This is a tcolorbox with a heading

Upper part of my box.

Lower part of my box.

**Statics Problem Example**




The shear leg derrick is used to haul the 200-kg net of fish onto the dock. Determine the compressive force along each of the legs AB and CB and the tension in the winch cable DB. Assume the force in each leg acts along its axis.

## 1.1 Python

**Listing 1:** Python code to create an incidence matrix

```
import numpy as np
def incmatrix(genl1,genl2):
    m = len(genl1)
    n = len(genl2)
    M = None #to become the incidence matrix
    VT = np.zeros((n*m,1), int)  #dummy variable
    x = 0
    #compute the bitwise xor matrix
    M1 = bitxormatrix(genl1)
    M2 = np.triu(bitxormatrix(genl2),1)

    for i in range(m-1):
        for j in range(i+1, m):
```

```
            [r,c] = np.where(M2 == M1[i,j])
            for k in range(len(r)):
                VT[(i)*n + r[k]] = 1;
                VT[(i)*n + c[k]] = 1;
                VT[(j)*n + r[k]] = 1;
                VT[(j)*n + c[k]] = 1;

                if M is None:
                    M = np.copy(VT)
                else:
                    M = np.concatenate((M, VT), 1)

                VT = np.zeros((n*m,1), int)

    return M
```

## 1.2 Matlab

**Listing 2:** MATLAB Code that tests Solar System Function

```
function test_advanced_level(unit_under_test)
    % TEST_ADVANCED_LEVEL Test the simulator against the advanced level of
   achievement.
    %
    % TEST_ADVANCED_LEVEL(@unit) tests a function called "unit" instead of the
    % default, "solarsystem".
    %
    % This is provided as a means for your to test your program's accuracy. We
    % supply here high precision answers that can use as a benchmark against
    % which to compare your code.
    %
    % A program similar to this one will be used during marking to test your
    % program's accuracy and speed. We'll use different initial conditions, so
    % don't try simply hard-coding these answers! :)
    %

    % Default to a function named "solarsystem"
    if nargin < 1
        unit_under_test = @solarsystem;
    end

    % Data
    % Data source: NASA JPL Development Emphemeris DE405, imported into Matlab
    % using https://au.mathworks.com/matlabcentral/fileexchange/46074-jpl-
   ephemeris-manager
    mass = [1.98879724324801e+30;3.30167548185139e+23;4.86825414184162e
   +24;5.97333182929537e+24;6.41814989746695e+23;1.89888757501372e
   +27;5.68569250232054e+26;8.68357411676561e+25;1.02450682828011e
   +26;1.47100387814202e+22];
    p = [-410978934.937975 -52564098.573049
   -11647539.5911275;-20263704896.5463 37298969437.5484
   21998926177.1807;107457059203.846 12751258164.7855
   -1081247256.91775;-104473131433.549 95807463843.1787
   41554965796.5625;-47532402438.2755 -197479402904.819
   -89286739068.5338;740812325977.265 -29623952257.2314
   -30753799138.017;-391719672964.493 1189107854643.27
   507856891148.711;-2396814857836.84 -1270773906334.37
   -522608874439.045;-1545201887440.28 -3957617757444.78
   -1581427940931.15;-4371341308972.33 -1084064015240.84 978703610774.062];
    v = [1.94673233456669 -10.8814016462929 -4.7775329435922;-54017.2779417951
    -18415.0969798133 -4228.50548119061;-3793.57777814318 31524.0648690534
   14419.9306824639;-21597.9402281813 -19392.9951239518
   -8410.50277824797;24596.1594690375 -2563.11636886769
   -1841.7251251432;538.777252737696 12558.0983493514
   5370.16231719295;-9767.15104601119 -2764.87492216388
   -721.832483731844;3335.76872430951 -5686.29309895411
   -2537.72389267233;5074.99185394443 -1640.69964089467
   -797.85361019039 5;1586.81468930053 -5301.34210829372 -2132.2921355 0457];

    % Use inner planets only; supply them in the order Sun, Earth, Mercury,
    % Venus, Mars (so that colours used for the Sun and Earth in the other
```

```
    % tests apply here too)
    i = [1 4 2 3 5];
    mass = mass(i);
    p = p(i,:);
    v = v(i,:);

    % Test 1
    Test_3D_Solar_System(false);

    % Test 2
    Test_3D_Solar_System(true);

        function test_result(parameter, value, units, comparator, benchmark)
            if strcmp(units, '%')
                fprintf('  %28s :  %-15.6f', [parameter ' (' units ')'], value);
            else
                fprintf('  %28s :  %-15.6g', [parameter ' (' units ')'], value);
            end

            if nargin == 5
                if comparator(value, benchmark)
                    fprintf('   ** PASS. Meets or exceeds the expectation of %g%s', benchmark, units);
                else
                    fprintf('   ** FAIL. Does not meet the expectation of %g%s', benchmark, units);
                end
            end
            fprintf('\n');
        end


        function Test_3D_Solar_System(speed_test)
            if speed_test
                fprintf('<strong>*** [Advanced level] Inner planets in 3D (execution speed test)</strong>\n');
            else
                fprintf('<strong>*** [Advanced level] Inner planets in 3D</strong>\n');
            end

            % Run the program
            tic();
            [final_p, final_v] = unit_under_test(p, v, mass, 400*24*60*60, speed_test);
            t = toc();
            test_result('Execution time', t, 's');

            % Check the dimensions of the return values
            assert(all(size(final_p) == size(p)), 'Expected size of return value "p" to be %ix%i, received %ix%i instead.', size(p,1), size(p,2), size(final_p, 1), size(final_p, 2));
```

```
         assert(all(size(final_v) == size(v)), 'Expected size of return value "v" to be %ix%i, received %ix%i instead.', size(v,1), size(v,2), size(final_p, 1), size(final_p, 2));

         % Check the answers
         correct_p = [-345966512.946938 -427734515.389726 -176305011.39972;-146624134718.92 23657267681.4718 10263838966.7501;18103318019.8 -57037628697.2036 -32327489902.5598;32774480992.525 -94215943100.9452 -44459425421.2662;-136512481872.172 183605819453.111 87921613716.9978];
         correct_v = [1.80779317569275 -10.8097599943337 -4.73922210995349;-5754.8524496641 -27006.432527836 -11711.495344779;37086.6176187111 15367.1705312566 4360.22910247245;33125.9176644671 10361.9441289187 2564.05625302394;-19228.3713286498 -10562.8647670158 -4323.54314113474];

         % mercury is harder to simulate because it moves the fastest
         % the objects are in this order: Sun, Earth, Mercury, Venus, Mars
         expectations = [0.1 1 5 1 1];
         for i = 1:size(p,1)
             test_result(sprintf('Object %i position error', i), norm(final_p(i,:) - correct_p(i,:))/norm(correct_p(i,:))*100, '%', @le, expectations(i));
             test_result(sprintf('Object %i velocity error', i), norm(final_v(i,:) - correct_v(i,:))/norm(correct_v(i,:))*100, '%', @le, expectations(i));
         end
     end

 end
```

It can clearly be seen from listings 1 to 2 that code chunks are cool and sick.

# 2 Figure Rendering

## 2.1 3D Plots

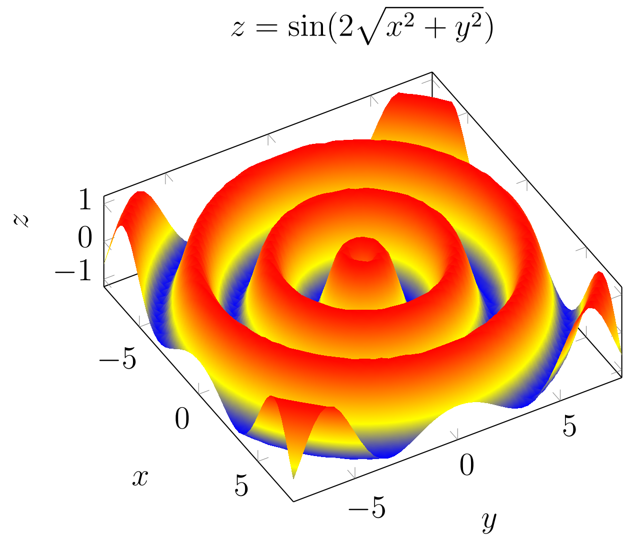



**Fig. 1.** 3D plot of $z = \sin(2\sqrt{x^2 + y^2})$

# 3 Table input from csv

| Country | Population | Area | Oil Prod. | GDP | Education | Roadways | Net Users |
|---|---|---|---|---|---|---|---|
| Australia | 23232413 | 7741220 | 289700 | 50300 | 5.6 | 0.106342024 | 60% |
| Canada | 35623680 | 9984670 | 3679000 | 48300 | 5.4 | 0.10439003 | 60% |
| France | 67106161 | 643801 | 16420 | 43800 | 5.9 | 1.597459463 | 60% |
| Germany | 80594017 | 357022 | 46590 | 50400 | 5.1 | 1.806611357 | 60% |
| Italy | 62137802 | 301340 | 70670 | 38100 | 4.5 | 1.618437645 | 60% |
| Japan | 126451398 | 377915 | 3918 | 42800 | 3.8 | 3.224989746 | 60% |
| Russia | 142257519 | 17098242 | 10550000 | 27800 | 4.1 | 0.075059588 | 60% |
| United Kingdom | 65648100 | 243610 | 933000 | 44100 | 6.2 | 1.619096096 | 60% |
| United States | 326625791 | 9833517 | 8853000 | 59500 | 5.4 | 0.669812235 | 60% |

**Table 1:** Your Table Caption