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```
format short
```

Problem 0

```
% no
```

Problem 1

```
% Part a
fprintf("\nPart a\n");

A = [
    2, 3, 1, 10;
    6, 14, 4, 24;
    -8, -7, -9, -100;

]

% Part b
fprintf("\nPart b\n");
A(2, :) = A(2, :) - 3*A(1, :)
A(3, :) = A(3, :) + 4*A(1, :)
A(3, :) = A(3, :) - A(2, :)

% Part c
fprintf("\nPart c\n");
A(3, :) = A(3, :)/-6
A(1, :) = A(1, :)/2
A(2, :) = A(2, :)/5
A(1, :) = A(1, :) - 1.5*A(2, :)
A(2, :) = A(2, :) - 0.2*A(3, :)
A(1, :) = A(1, :) - 0.2*A(3, :)

% Part d
fprintf("\nPart d\n");
fprintf("solution: x1: %.2f, x2: %.2f, x3: %.2f\n", A(1, 4), A(2, 4), A(3,
4));
```

```
Part a

A =

     2     3     1    10
     6    14     4    24
    -8    -7    -9  -100


Part b

A =

     2     3     1    10
     0     5     1    -6
    -8    -7    -9  -100


A =

     2     3     1    10
     0     5     1    -6
     0     5    -5   -60


A =

     2     3     1    10
     0     5     1    -6
     0     0    -6   -54


Part c

A =

     2     3     1    10
     0     5     1    -6
     0     0     1     9


A =

    1.0000    1.5000    0.5000    5.0000
         0    5.0000    1.0000   -6.0000
         0         0    1.0000    9.0000


A =

    1.0000    1.5000    0.5000    5.0000
         0    1.0000    0.2000   -1.2000
         0         0    1.0000    9.0000
```

```
A =

    1.0000         0    0.2000    6.8000
         0    1.0000    0.2000   -1.2000
         0         0    1.0000    9.0000


A =

    1.0000         0    0.2000    6.8000
         0    1.0000         0   -3.0000
         0         0    1.0000    9.0000


A =

    1.0000         0   -0.0000    5.0000
         0    1.0000         0   -3.0000
         0         0    1.0000    9.0000


Part d
solution: x1: 5.00, x2: -3.00, x3: 9.00
```

Problem 2

```
% Part a
fprintf("\nPart a\n");

B = [
    1, 4, 3, -1, 0, 8;
    3, 10, 15, 2, 11, 28;
    2, 6, 12, 6, 20, 14;
    0, 8, -24, -29, -71, 2;
]

% Part b
fprintf("\nPart b\n");
B(2, :) = B(2, :) - 3*B(1, :)
B(3, :) = B(3, :)/2
B(3, :) = B(3, :) - B(1, :)
B(3, :) = B(3, :) - B(2, :)/2
B(4, :) = B(4, :) + 4*B(2, :)
B([3, 4], :) = B([4, 3], :)
B(4, :) = B(4, :) + B(3, :)/6

% Part c
fprintf("\nPart c\n");
B(3, :) = -B(3, :)/9
B(1, :) = B(1, :) + 2*B(2, :)
B(2, :) = -B(2, :)/2
```

```
B(1, :) = B(1, :) - 9*B(3, :)
B(2, :) = B(2, :) + (2.5)*B(3, :)

% Part d
fprintf("\nPart d\n");

rref(B)

% Part e
x0_v = [34; -7; 0; -2; 0]
x3_v = [-15; 3; 1; 0; 0]
x5_v = [5; -2; 0; -3; 1]
```

```
Part a

B =

     1     4     3    -1     0     8
     3    10    15     2    11    28
     2     6    12     6    20    14
     0     8   -24   -29   -71     2


Part b

B =

     1     4     3    -1     0     8
     0    -2     6     5    11     4
     2     6    12     6    20    14
     0     8   -24   -29   -71     2


B =

     1     4     3    -1     0     8
     0    -2     6     5    11     4
     1     3     6     3    10     7
     0     8   -24   -29   -71     2


B =

     1     4     3    -1     0     8
     0    -2     6     5    11     4
     0    -1     3     4    10    -1
     0     8   -24   -29   -71     2


B =

    1.0000    4.0000    3.0000   -1.0000         0    8.0000
         0   -2.0000    6.0000    5.0000   11.0000    4.0000
```

```
         0         0         0    1.5000    4.5000   -3.0000
         0    8.0000  -24.0000  -29.0000  -71.0000    2.0000


B =

    1.0000    4.0000    3.0000   -1.0000         0    8.0000
         0   -2.0000    6.0000    5.0000   11.0000    4.0000
         0         0         0    1.5000    4.5000   -3.0000
         0         0         0   -9.0000  -27.0000   18.0000


B =

    1.0000    4.0000    3.0000   -1.0000         0    8.0000
         0   -2.0000    6.0000    5.0000   11.0000    4.0000
         0         0         0   -9.0000  -27.0000   18.0000
         0         0         0    1.5000    4.5000   -3.0000


B =

     1     4     3    -1     0     8
     0    -2     6     5    11     4
     0     0     0    -9   -27    18
     0     0     0     0     0     0

Part c

B =

     1     4     3    -1     0     8
     0    -2     6     5    11     4
     0     0     0     1     3    -2
     0     0     0     0     0     0


B =

     1     0    15     9    22    16
     0    -2     6     5    11     4
     0     0     0     1     3    -2
     0     0     0     0     0     0


B =

    1.0000         0   15.0000    9.0000   22.0000   16.0000
         0    1.0000   -3.0000   -2.5000   -5.5000   -2.0000
         0         0         0    1.0000    3.0000   -2.0000
         0         0         0         0         0         0
```

```
B =

    1.0000         0   15.0000         0   -5.0000   34.0000
         0    1.0000   -3.0000   -2.5000   -5.5000   -2.0000
         0         0         0    1.0000    3.0000   -2.0000
         0         0         0         0         0         0


B =

     1     0    15     0    -5    34
     0     1    -3     0     2    -7
     0     0     0     1     3    -2
     0     0     0     0     0     0


Part d

ans =

     1     0    15     0    -5    34
     0     1    -3     0     2    -7
     0     0     0     1     3    -2
     0     0     0     0     0     0


x0_v =

    34
    -7
     0
    -2
     0


x3_v =

   -15
     3
     1
     0
     0


x5_v =

     5
    -2
     0
    -3
     1
```

Problem 3

```
% Part a
fprintf("\nPart a\n");
A = [
    7, 8, -2, 2;
    -6, 0, 6, -6;
    6, -5, 3, 6;
]

rref(A)

% Part b
fprintf("\nPart b\n");
fprintf("solution: x1: %.2f, x2: %.2f, x3: %.2f\n", A(1, 4), A(2, 4), A(3,
4));

% Part c
fprintf("\nPart c\n");
format rat
rref(A)

% Part d
fprintf("\nPart d\n");
fprintf("solution: x1: %.2f, x2: %.2f, x3: %.2f\n", A(1, 4), A(2, 4), A(3,
4));
```

```
Part a

A =

     7     8    -2     2
    -6     0     6    -6
     6    -5     3     6


ans =

    1.0000         0         0    0.7423
         0    1.0000         0   -0.4639
         0         0    1.0000   -0.2577


Part b
solution: x1: 2.00, x2: -6.00, x3: 6.00

Part c

ans =

       1             0             0            72/97
       0             1             0           -45/97
```

```
       0              0              1            -25/97
```

Part d
solution: x1: 2.00, x2: -6.00, x3: 6.00

Problem 4

```
format short

% Part a

% Equation #1: 270*x1 + 51*x2 + 70*x3 = 400
% Equation #2: 10*x1 + 5.4*x2 + 15*x3 = 30
% Equation #3: 2*x1 + 5.2*x2 + 0*x3 = 10
fprintf("\nPart a\n");
A = [
    270, 51, 70, 400;
    10, 5.4, 15, 30;
    2, 5.2, 0, 10;
]

rref(A)

% Part b

% Equation #1: 51*x2 + 70*x3 + 260*x4 = 400
% Equation #2: 5.4*x2 + 5154*x3 + 9*x4 = 30
% Equation #3: 5.2*x2 + 0*x3 + 5*x4 = 10
fprintf("\nPart b\n");
A = [
    51, 70, 260, 400;
    5.4, 15, 9, 30;
    5.2, 0, 5, 10;
]

rref(A)
```

```
Part a

A =

  270.0000   51.0000   70.0000  400.0000
   10.0000    5.4000   15.0000   30.0000
    2.0000    5.2000         0   10.0000


ans =

    1.0000         0         0    0.9858
         0    1.0000         0    1.5439
         0         0    1.0000    0.7870
```

```
Part b

A =

   51.0000   70.0000  260.0000  400.0000
    5.4000   15.0000    9.0000   30.0000
    5.2000         0    5.0000   10.0000


ans =

    1.0000         0         0    0.8760
         0    1.0000         0    1.0313
         0         0    1.0000    1.0890
```

Problem 5

```
% Part a
fprintf("\nPart a\n");
A = [
    5.2, 16.4, 4.2;
    3.6, 22.2, 3.6;
    9.2, 25.4, 7.2;
]

rref(A)

% Part b
fprintf("\nPart b\n");
fprintf("The given vector is in the span of the other two because there's a
free variable\n");

% Part c
fprintf("\nPart c\n");
fprintf("The three vectors are linearly dependent because not all the weights
are 0\n");
```

```
Part a

A =

    5.2000   16.4000    4.2000
    3.6000   22.2000    3.6000
    9.2000   25.4000    7.2000


ans =

    1.0000         0    0.6064
```

```
         0    1.0000    0.0638
         0         0         0
```

Part b
The given vector is in the span of the other two because there's a free variable

Part c
The three vectors are linearly dependent because not all the weights are 0

Problem 6

```
% Part a
fprintf("\nPart a\n");
syms a b

% Part b
fprintf("\nPart b\n");
A = [
    4, -7, a;
    -5, -4, b;
]

rref(A)

% Part c
fprintf("\nPart c\n");
w1 = (4*a)/51 - (7*b)/51
w2 = - (5*a)/51 - (4*b)/51
```

```
Part a

Part b

A =

[ 4, -7, a]
[-5, -4, b]


ans =

[1, 0,   (4*a)/51 - (7*b)/51]
[0, 1, - (5*a)/51 - (4*b)/51]


Part c

w1 =

(4*a)/51 - (7*b)/51
```

```
w2 =

- (5*a)/51 - (4*b)/51
```

Problem 7

```
% Part a
fprintf("\nPart a\n");
A = [
    6, -7, 5, 35, -9, 0;
    4, 6, 1, -18, 1, 0;
    1, 5, 4, 0, 7, 0;
    5, 6, -8, -55, 5, 0;
]

rref(A)

% Part b
fprintf("\nPart b\n");
fprintf("The vectors are linearly dependent not every column has a pivot\n")

% Part c
fprintf("\nPart c\n");
1*A(:, 1) + 3*A(:, 2) - 4*A(:, 3) + 1*A(:, 4) + 0*A(:, 5)

% Part d
fprintf("\nPart d\n");
fprintf("Because the number of vectors (5) is greater than the number of
entries (4), therefore the set must be linearly dependent\n");

% Part e
fprintf("\nPart e\n");
fprintf("The coefficient matrix has a pivot in every row so this set of
vectors spans R^4\n")
```

```
Part a

A =

     6    -7     5    35    -9     0
     4     6     1   -18     1     0
     1     5     4     0     7     0
     5     6    -8   -55     5     0


ans =

     1     0     0    -1     0     0
     0     1     0    -3     0     0
```

```
     0     0     1     4     0     0
     0     0     0     0     1     0
```

```
Part b
The vectors are linearly dependent not every column has a pivot

Part c

ans =

     0
     0
     0
     0


Part d
Because the number of vectors (5) is greater than the number of entries (4),
therefore the set must be linearly dependent

Part e
The coefficient matrix has a pivot in every row so this set of vectors spans
R^4
```

Published with MATLAB® R2023b