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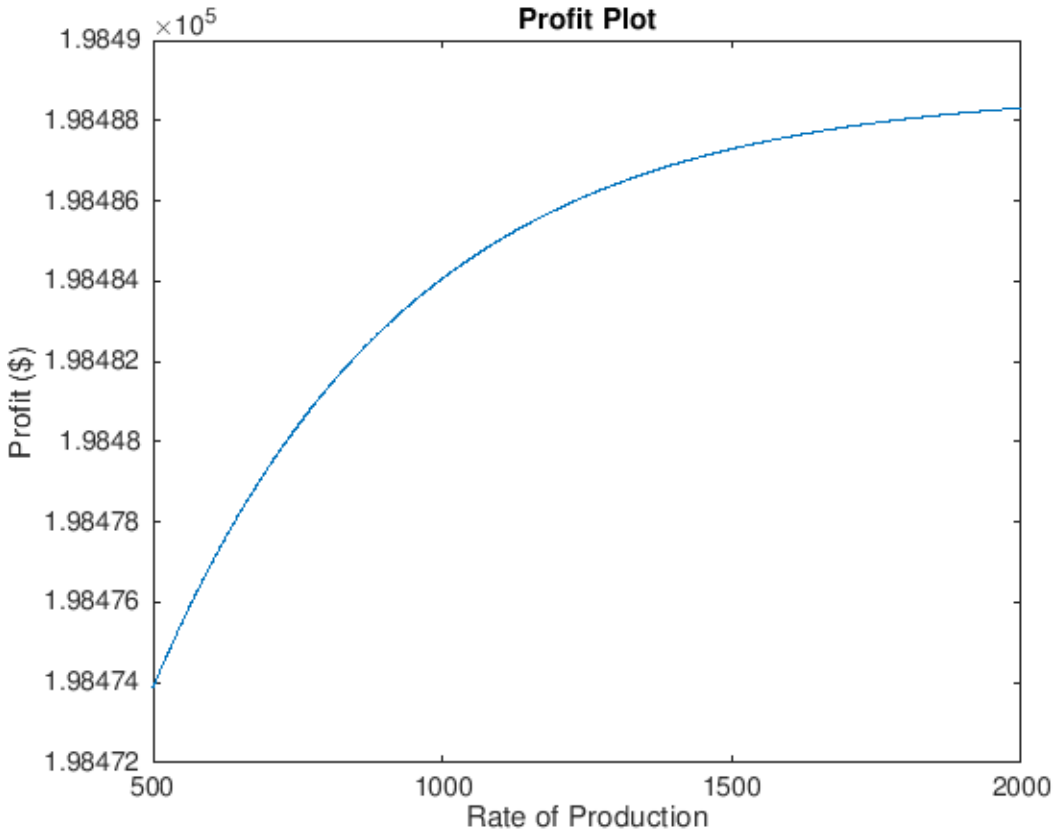
```
clc;
clear;
% Kathryn Atherton
% Quiz 4 - Take Home Portion
```

Part A - Current Equipment

```
x = 500:1:20000;
c = costperunit(x);
i = income(x);
p = i - c;

fprintf('Computational model for profit:\n');
fprintf('    profit = income(x) - costperunit(x)\n');
fprintf('    profit = (20000 * x / (10 + 0.1 * x)) - (exp(5 - 0.0023 *
 x) + 20)\n');
fprintf('Plot of profit:\n');
figure
plot(p);
xlabel('Rate of Production');
ylabel('Profit ($)');
xlim([500,2000]);
title('Profit Plot');

fprintf('Maximum profit\n');
fprintf('To find the maximum, find the root of the second derivative.
\n');

error = 0.000000001;
x = 500;
fx = ddprofit(x);

while (abs(fx) > error) && (x < 2000)
    m = -0.00000180574 .* exp(-0.0023 .* x) + (12000000) ./ (x+100) .^
 4;
    b = fx - m * x;
    x = -b / m;
    if x > 2000
        x = 2000;
    end
    fx = ddprofit(x);
end
```

```
max = income(x) - costperunit(x);

fprintf('Maximum profit ($%.0f) is at a rate of production of %.0f.
\n',max,x);
```

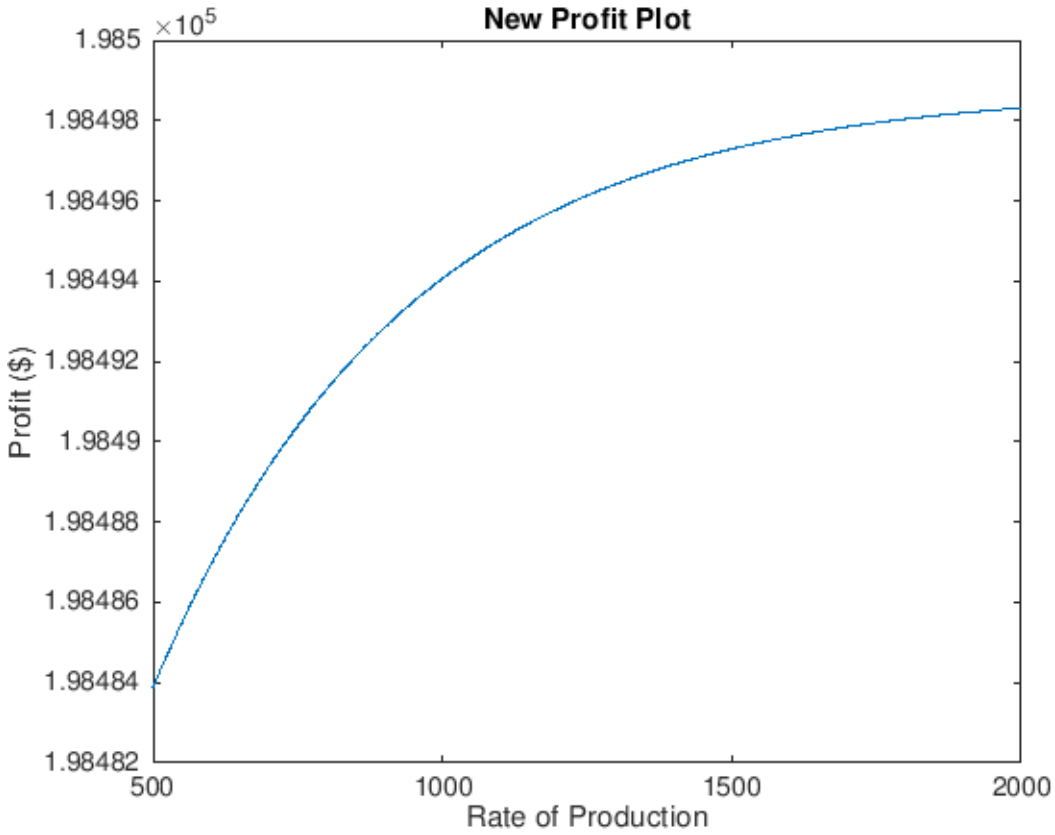
```
Computational model for profit:
    profit = income(x) - costperunit(x)
    profit = (20000 * x / (10 + 0.1 * x)) - (exp(5 - 0.0023 * x) + 20)
Plot of profit:
Maximum profit
To find the maximum, find the root of the second derivative.
Maximum profit ($190455) is at a rate of production of 2000.
```



Part B - New Equipment

```
x = 500:1:20000;
cnew = costnew(x);

p = i - cnew;

fprintf('Computational model for profit:\n');
fprintf('    profit = income(x) - costnew(x)\n');
fprintf('    profit = (20000 * x / (10 + 0.1 * x)) - (exp(5 - 0.0023 *
 x) + 10)\n');
```

```
fprintf('Plot of profit:\n');
figure
plot(p);
xlabel('Rate of Production');
ylabel('Profit ($)');
xlim([500,2000]);
title('New Profit Plot');

x = 500;
fx = ddprofitnew(x);

while (abs(fx) > error) && (x < 2000)
    m = -0.00000180574 .* exp(-0.0023 .* x) + (12000000) ./ (x+100) .^
 4;
    b = fx - m * x;
    x = -b / m;
    if x > 2000
        x = 2000;
    end
    fx = ddprofit(x);
end

maxnew = income(x) - costnew(x);

fprintf('Maximum profit ($%.0f) is at a rate of production of %.0f.
\n',maxnew,x);

Computational model for profit:
    profit = income(x) - costnew(x)
    profit = (20000 * x / (10 + 0.1 * x)) - (exp(5 - 0.0023 * x) + 10)
Plot of profit:
Maximum profit ($190465) is at a rate of production of 2000.
```



Part C -- Recommendation

```
maxdiff = maxnew - max;

cost_machine = 2000000;
time = cost_machine / (maxnew - max);

fprintf('Payback time is %.0f months.\n', time);

fprintf('I do not believe that the company should invest in this
 new equipment.\nThe cost per unit of the new equipment is not
 significantly different from that of the current equipment.\nAs such,
 the payback time is too long to be worth investing.\nBy the time
 TAOCO pays back the price of the new equipment, it is likely that
 much better technology will be in the market.\n');
```

```
Payback time is 200000 months.
I do not believe that the company should invest in this new equipment.
The cost per unit of the new equipment is not significantly different
 from that of the current equipment.
As such, the payback time is too long to be worth investing.
By the time TAOCO pays back the price of the new equipment, it is
 likely that much better technology will be in the market.
```

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