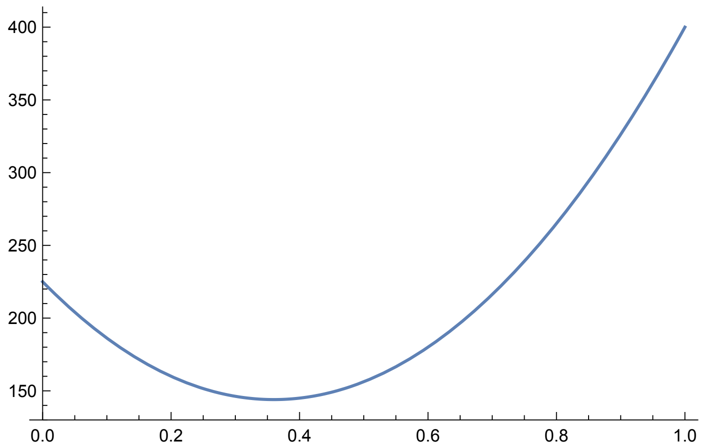
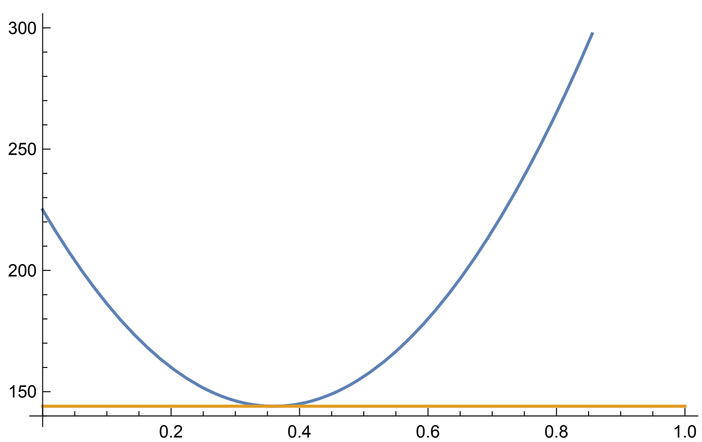
```
(* Quiz 26 | AP Calculus AB | Prepared by D. Shubleka*)

(* Problem 1 *)

y[t_] := 20 t;

x[t_] := -15 + 15 t;

Q[t_] := (20 t) ^2 + (-15 + 15 t) ^2;

Plot[Q[t], {t, 0, 1}]
```




```
Simplify[Q'[t]]
```

50 (-9 + 25 t)

```
Plot[{Q[t], Q[9 / 25]}, {t, 0, 1}]
```



The miminum of the square of the distance occurs at t = 9/25. This corresponds to 2:21:36PM. Distance itself will be at a minimum at this time as well. In this problem we should remember to justify the identified point is a minimum (and not a maximum or neither) by using the First Derivative Test or the Second Derivative Test for Global Extrema.)

```
(* Problem 2 *)

f[x_] := 1 / (x^2 - 9);
```

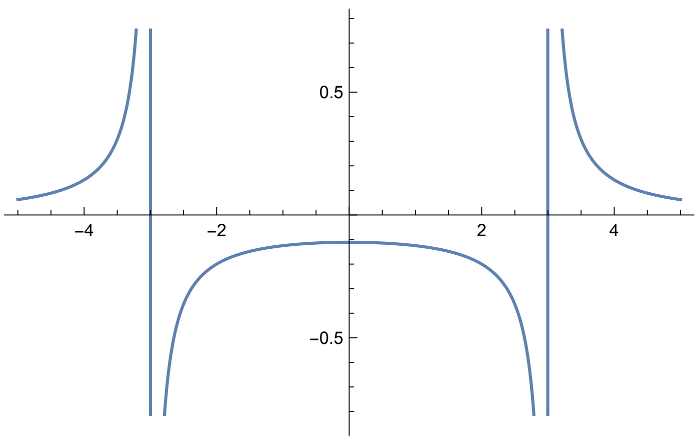
```
Simplify[f'[x]]
```

$$-\frac{2\,x}{\left(-9+x^2\right)^2}$$

```
Simplify[f''[x]]
```

$$\frac{6\left(3+x^2\right)}{\left(-9+x^2\right)^3}$$

```
Plot[f[x], {x, -5, 5}]
```



Comment: construct tables for each derivative; identify local extrema (one local max, no global extrema), inflection points (none), asymptotes (two VA, one HA), intercepts, ID behavior, and concavity.

```
(* Problem 1 *)
```

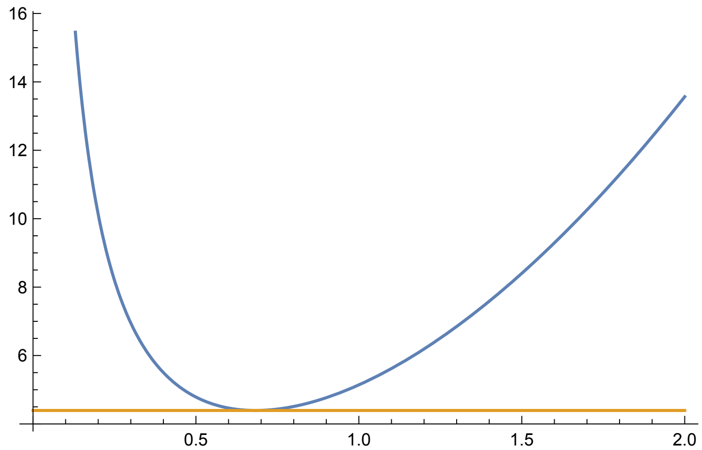
Suppose the volume is 1 cubic unit.

```
Q[r_] := Pi r^2 + 2 Pi r (1 / (Pi r^2));
```

```
Simplify[Q'[r]]
```

$$-\frac{2}{r^2}+2\,\pi\,r$$

```
Plot[{Q[r], Q[(1 / (Pi)) ^ (1 / 3)]}, {r, 0, 2}]
```



The precise critical number is r = (V / Pi)^(1/3). The other dimension is h = V / (Pi r^2) = (V / Pi)^(1/3). Use the First or Second Derivative for Global Extrema to justify that the critical number gives an absolute minimum.

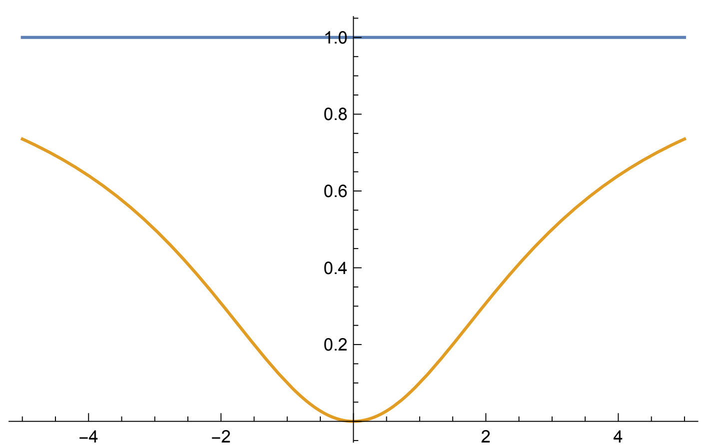
```
(* Problem 2 *)

g[x_] := x^2 / (x^2 + 9);

Simplify[g'[x]]
```

$$\frac{18\,x}{\left(9+x^2\right)^2}$$

```
Simplify[g''[x]]
```

$$-\frac{54\left(-3+x^2\right)}{\left(9+x^2\right)^3}$$

```
Plot[{1, g[x]}, {x, -5, 5}]
```



Comment: construct tables for each derivative; identify local extrema (one local and global min), inflection points (two), asymptotes (no VA, one HA), intercepts, ID behavior, and concavity.