Chapter 2

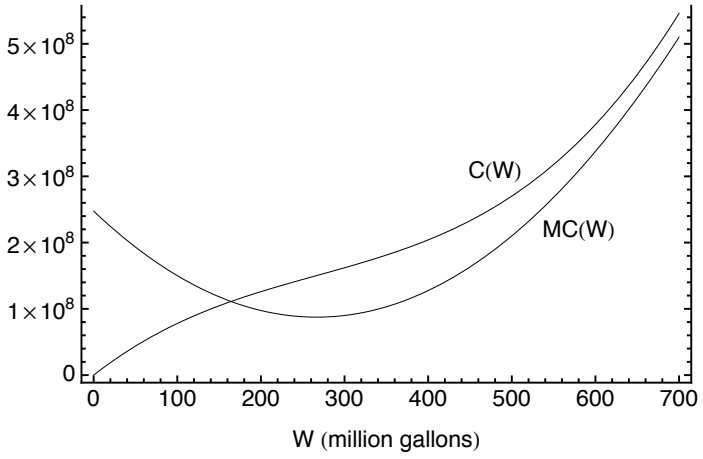
graph formating

```
thinn = AbsoluteThickness[.5];
medum = AbsoluteThickness[1.];
thick = AbsoluteThickness[1.5];
black = GrayLevel[0];
BGray = GrayLevel[0.3];
WGray = GrayLevel[0.6];
SetOptions[Plot, PlotStyle → {{thinn, Black}, {thinn, Black}, {thinn, Black}},
  PlotPoints → 40, ImageSize → 360,
  FrameStyle -> medum, AxesStyle -> medum,
  BaseStyle -> {FontFamily -> "Helvetica", FontSlant → Plain, FontSize → 12}];
SetOptions[ListPlot, AxesStyle -> medum, PlotStyle → medum, ImageSize → 384,
  BaseStyle -> {FontFamily -> "Helvetica", FontSlant -> "Plain", FontSize → 12}];
SetOptions[ParametricPlot, PlotStyle →
   {{thinn, Black}, {thinn, Black}, {thinn, Black}}, PlotPoints → 40,
  FrameStyle -> medum, AxesStyle -> medum, PlotStyle → medum,
  BaseStyle -> {FontFamily -> "Helvetica", FontSlant -> "Plain", FontSize → 12}];
SetOptions[Graphics, BaseStyle ->
   {FontFamily -> "Helvetica", FontSlant -> "Plain", FontSize → 12}];
```

2.1 Cost Functions

```
a = 3300.;
b = -8.;
c = 0.01;
tc = 300 * (a * w + b * w^2 + c * w^3);
mc = ∂_w tc;
(* s below is a scaling factor for mc, allowing mc to be plotted alongside tc *)
s = 250.;
pl21a = Plot[{tc, s * mc}, {w, 0, 700},
   Frame → {{True, True}, {True, False}},
   FrameLabel → {"W (million gallons)", None, None, None}];
```

```
pl21 = Show[pl21a,
  Graphics[Text[StyleForm["C(W)", FontSlant -> "Plain"], {480, 310 000 000}]],
  Graphics[Text[StyleForm["MC(W)", FontSlant -> "Plain"], {580, 220 000 000}]]]
```



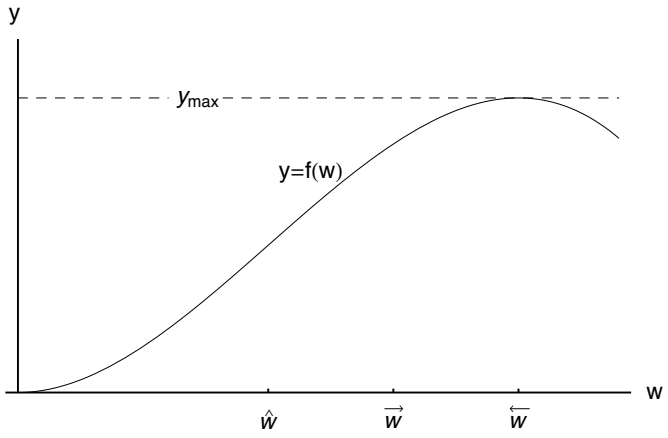

```
Solve[∂w mc == 0, w]
```

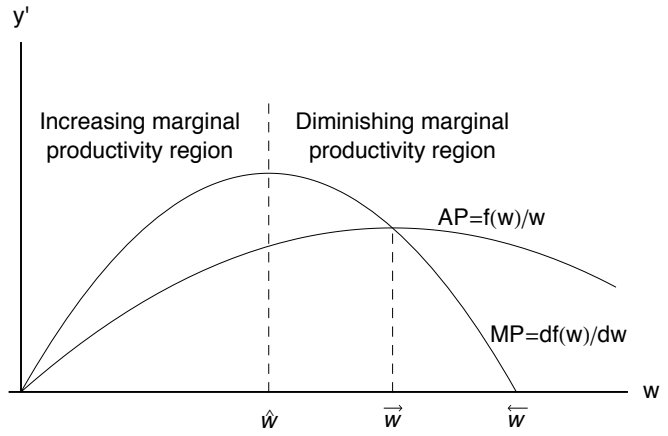
```
{{w → 266.667}}
```

2.2 ,2.3a,2.3b,2.4 Production Function to Demand

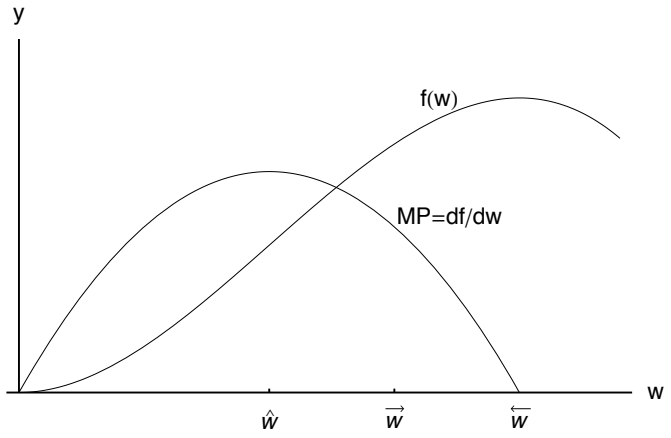
```
a = 0.;
b = .003;
c = -.001;
y = a * w + b * w^2. + c * w^3;
Solve[D[y, w] == 0, w];
maxw = w /. %[[2]];
maxy = y /. w → maxw;
Solve[D[y, {w, 2}] == 0, w];
mpmaxw = w /. %[[1]];
mp = D[y, w];
ap = y / w;
maxmp = mp /. w → minw;
d1 = 0.;
d2 = .001;
mc = d1 + d2 * w;
py = 1.;
vmp = py * mp;
vap = py * ap;
Solve[vmp == vap, w];
minw = w /. %[[2]];
miny = vmp /. w -> minw;
Solve[mc - vmp == 0, w];
maxpi = w /. %[[2]];
pl22a = Plot[y, {w, 0, 1.2 * maxw},
    PlotRange → {0, 1.2 * maxy},
    AxesLabel → {"w", "y "},
    Ticks → {{{mpmaxw, "ŵ", {0.00625, 0.}, {black, medum}}, {minw, "w⃗", {0.00625, 0.},
```

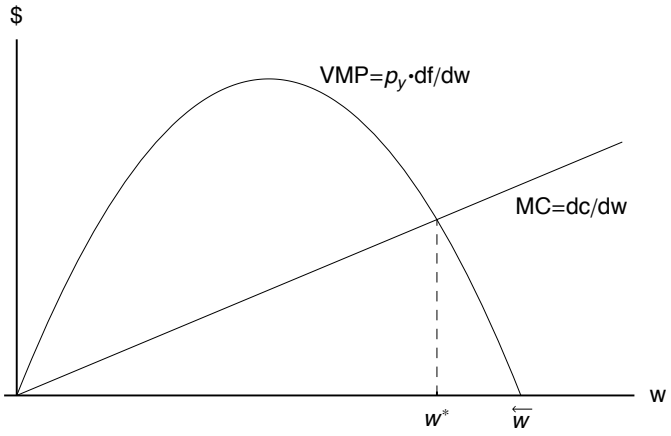
```
        {black, medum}}, {maxw, "w←", {0.00625, 0.}, {black, medum}}}, {}},
    AspectRatio → 0.565
   ];
pl22b = Show[pl22a,
  Graphics[Text["y_max", {.72, maxy}]],
  Graphics[Text["y=f(w)", {1.17, 0.003}]],
  Graphics[{Dashing[{.015, .015}], Line[{{0, maxy}, {0.6, maxy}}]}],
   Graphics[{Dashing[{.015, .015}], Line[{{0.82, maxy}, {1.2 * maxw, maxy}}]}]];
pl22c = Plot[{ap, mp}, {w, 0, 1.2 * maxw},
    PlotRange → {0, 1.2 * maxy},
    AxesLabel → {"w", "y'"},
    Ticks → {{{mpmaxw, "ŵ", 0}, {minw, "w→", 0}, {maxw, "w←", 0}}, {}},
    AspectRatio → 0.565
   ];
pl22d = Show[pl22c,
  Graphics[Text["MP=df(w)/dw", {2.17, .0008}]],
  Graphics[Text["AP=f(w)/w", {1.9, .0024}]],
  Graphics[Text["Increasing marginal", {.48, .0037}]],
  Graphics[Text["productivity region", {.48, .0033}]],
  Graphics[Text["Diminishing marginal", {1.54, .0037}]],
  Graphics[Text["productivity region", {1.54, .0033}]],
  Graphics[{Dashing[{.015, .015}], Line[{{mpmaxw, 0}, {mpmaxw, 0.004}}]}],
   Graphics[{Dashing[{.015, .015}], Line[{{minw, 0}, {minw, miny}}]}]
  ];
pl22 = Show[GraphicsGrid[{{pl22b}, {pl22d}}], ImageSize → 432]
```


y
y_{max}
y=f(w)
w
$\hat{w}$
$\overrightarrow{w}$
$\overleftarrow{w}$


y'
Increasing marginal productivity region
Diminishing marginal productivity region
AP=f(w)/w
MP=df(w)/dw
w
$\hat{w}$
$\overrightarrow{w}$
$\overleftarrow{w}$

```
pl23a = Plot[{y, mp}, {w, 0, 1.2 * maxw},
    PlotRange → {0, 1.2 * maxy},
    AxesLabel → {"w", "y"},
    Ticks → {{{mpmaxw, "ŵ", {0.00625, 0.}, {black, medum}}, {minw, "w⃗", {0.00625, 0.},
         {black, medum}}, {maxw, "w⃖", {0., 0.}, {black, medum}}}, {}},
    AspectRatio → 0.565
   ];
pl23b = Show[pl23a,
    Graphics[Text[StyleForm["f(w)", FontSlant -> "Plain"], {0.84 * maxw, 1.0 * maxy}]],
    Graphics[
     Text[StyleForm["MP=df/dw", FontSlant -> "Plain"], {0.86 * maxw, 0.6 * maxy}]]
   ];
pl23c = Plot[{mc, vmp}, {w, 0, 1.2 * maxw},
    PlotRange → {0, 1.5 * py * maxmp},
    AxesLabel → {"w", "$"},
    Ticks → {{{maxpi, "w*", {0.00625, 0.}, {black, medum}},
       {maxw, "w⃖", {0., 0.}, {black, medum}}}, {}},
    AspectRatio → 0.565
   ];
pl23d = Show[pl23c,
    Graphics[Text[StyleForm["VMP=p_y·df/dw", FontSlant -> "Plain"],
      {minw, 0.75 * maxy}]], Graphics[
     Text[StyleForm["MC=dc/dw", FontSlant -> "Plain"], {1.1 * maxw, 0.45 * maxy}]],
    Graphics[{Dashing[{.015, .015}], Line[{{maxpi, 0}, {maxpi, mc /. w → maxpi}}]}]
   ];
pl23 = Show[GraphicsColumn[{pl23b, pl23d}], ImageSize → 432]
```


y
f(w)
MP=df/dw
w
$\hat{w}$
$\overrightarrow{w}$
$\overleftarrow{w}$


$
VMP=p_y·df/dw
MC=dc/dw
w
w^*
$\overleftarrow{w}$

```
Solve[vmp == p, w];
wdemand = w /. %[[2]];
pdemand = p /. Flatten[Solve[w == wdemand, p]];
pl24a =
  Plot[{0, Which[w < minw, , minw ≤ w ≤ maxw, pdemand, w > maxw,]}, {w, 0, 1.2 * maxw},
   AxesOrigin → {0, 0},
   AxesLabel → {"w", "p"},
   Ticks → {{{minw, "w⃗", {0.00625, 0.}, {black, medum}},
       {maxw, "w⃖", {0.0, 0.}, {black, medum}}}, {}},
   AspectRatio → 0.4
  ];
pl24 = Show[pl24a,
  Graphics[Text["w=D(p)", {0.9 * maxw, 0.45 * maxy}]]
 ]
```