```
Exit[]

$Assumptions = μ > 0 && σ > 0 && a ∈ Reals && 1 > k1 ≥ 0 &&
   k0 ≥ 0 && S0 > 0 && K > 0 && r ≥ 0 && b ∈ Reals && rf ≥ 0 && γ > 0;

ost == σ Sqrt[t] ; mpr == (μ - r)/σ^2 ;

xx[W_, mpr_, ost_] := Exp[ ost W + (mpr - 1 / 2) ost^2];
Δ[k_] := 1 / 2 (1 + Erf[(-Log[k] + ost^2 / 2) / ost]) - 1 // N
Δ[0.] = 0;

γ = .1; mpr = 0.1; ost = .01;

NIntegrate[xx[w, mpr, ost] Exp[-w^2 / 2], {w, -∞, ∞}] / Sqrt[2 π] - Exp[mpr ost^2]

pr[f_] :=
  Log[NIntegrate[Exp[-γ f[xx[w, mpr, ost]] - w^2 / 2], {w, -∞, ∞}] / Sqrt[2 π] ] / -γ;
opt2[f_] := NIntegrate[Exp[-γ f[xx[w, mpr, ost]] - w^2 / 2]
    (xx[w, mpr, ost] - 1), {w, -∞, ∞}];
opt[f_] := Min[.1, Max[-.1, opt2[f]]]

h[a_] := a (# - 1) &
put[k_, a_] := h[a][#] - Max[0, k - #] &;

-6.54587 × 10^-13

γ = .1; mpr = 0.1; ost = 1; arb = Quiet[FindRoot[opt2[h[b]] == 0, {b, 0, 10}][[1, 2]]]
hedge[k_] :=
 If[opt2[put[k, 0]] ≤ 0, 0, FindRoot[opt2[put[k, a]] == 0, {a, 0, 10}][[1, 2]]]

plot[kl_] := Module[{x = Quiet[hedge[#]] & /@ kl, y, i = 1},
  y = Max[x];
  Show[ParallelTable[With[{j = i++},
     Plot[pr[put[k, a]] - put[k, a][1], {a, 0, 3 y},
      PlotStyle → {ColorData[1, "ColorList"][[j]]}
     ]], {k, kl}],
   PlotRange → All,
   Epilog → Flatten[{Directive[{Dashed, Red}],
      Table[
       {Point[{x[[i]], 0}],
        Point[{x[[i]], pr[put[kl[[i]], x[[i]]]] - put[kl[[i]], x[[i]]][1]}]}
       , {i, Length[kl]}]}]
  ]]

0.621583

$Assumptions = k ≥ 0 && b > 0;

ost =.; mpr =.
```

```
D[f[a, w, b], a]
```

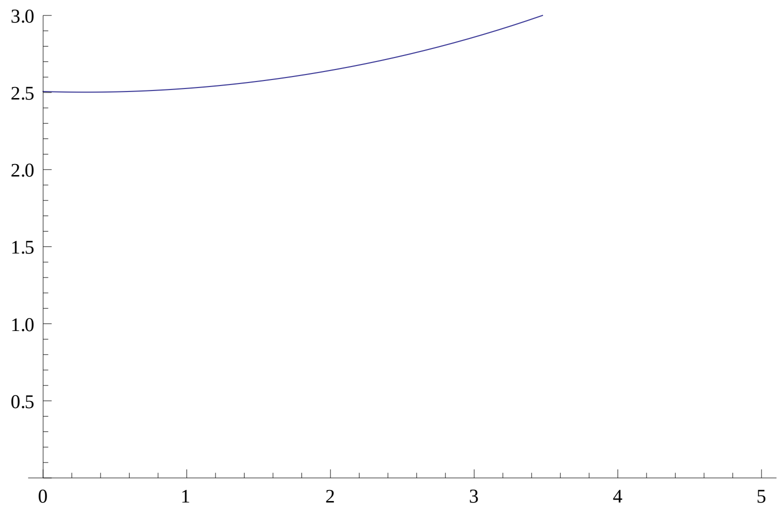
$$e^{-a\left(-1+e^{\left(-\frac{1}{2}+\text{mpr}\right)\text{ost}^2+\text{ost}\,w-b\,w^2}\right)-\frac{w^2}{2}}\left(1-e^{\left(-\frac{1}{2}+\text{mpr}\right)\text{ost}^2+\text{ost}\,w-b\,w^2}\right)$$

```
f[a_, w_, b_, t_] := Exp[-a (e^((mpr -1/2) t^2 + t w - b w^2) - 1) - w^2/ 2]
```

$$\text{df}[a\_, w\_, b\_, t\_] := e^{-a\left(-1+e^{\left(-\frac{1}{2}+\text{mpr}\right)t^2+t\,w-b\,w^2}\right)-\frac{w^2}{2}}\left(1-e^{\left(-\frac{1}{2}+\text{mpr}\right)t^2+t\,w-b\,w^2}\right)$$

```
g[a_, b_, t_] := NIntegrate[f[a, w, b, t], {w, -∞, ∞}]
dg[a_, b_, t_] := NIntegrate[df[a, w, b, t], {w, -∞, ∞}]
```

```
mpr = .3; Plot[g[a, .0, .2], {a, 0, 5}, PlotRange → {0, 3}]
```




```
Normal[Series[df[a, w, 0, t], {t, 0, 3}]]
```

$$-e^{-\frac{w^2}{2}}\,t\,w+\frac{1}{2}e^{-\frac{w^2}{2}}\,t^2\left(1-2\,\text{mpr}-w^2+2\,a\,w^2\right)-$$
$$\frac{1}{6}e^{-\frac{w^2}{2}}\,t^3\,w\left(-3+6\,a+6\,\text{mpr}-12\,a\,\text{mpr}+w^2-6\,a\,w^2+3\,a^2\,w^2\right)$$

```
Integrate[, {w, -∞, ∞}]
```

$$\sqrt{\frac{\pi}{2}}\left(2+a\,t\left(2\,b+3\,(-1+a)\,b^2\,t+(a-2\,\text{mpr})\,t\right)\right)$$

MinValue$\left[\sqrt{\frac{\pi}{2}}\ \left(2+a\,t\,\left(2\,b+3\,(-1+a)\,b^2\,t+(a-2\,mpr)\,t\right)\right),\ \{a\}\right]$

$$\begin{cases} \sqrt{2\,\pi} & (b>0\,\&\&\,t==0)\,\|\,(b<0\,\&\&\,t==0) \\ \frac{1}{4}\left(4\sqrt{2\,\pi}-2\,mpr^2\sqrt{2\,\pi}\ t^2\right) & b==0 \\ \frac{1}{4+12\,b^2}\left(4\sqrt{2\,\pi}+10\,b^2\sqrt{2\,\pi}+6\,b^3\sqrt{2\,\pi}\ t+4\,b\,mpr\sqrt{2\,\pi}\ t-9\,b^4\sqrt{\frac{\pi}{2}}\ t^2-6\,b^2\,mpr\sqrt{2\,\pi}\ t^2-2\,mpr^2\sqrt{2\,\pi}\ t^2\right) & \text{True} \end{cases}$$

Series[%, {t, 0, 2}]

$$\sqrt{2\,\pi}+a\,b\sqrt{2\,\pi}\ t+\left(a^2-3\,a\,b^2+3\,a^2\,b^2-2\,a\,mpr\right)\sqrt{\frac{\pi}{2}}\ t^2+O[t]^3$$

Integrate$\left[\text{SeriesCoefficient}\left[df\left[a,\ w,\ b\sqrt{t},\ t\right],\ \{t,\ 0,\ 2\}\right],\ \{w,\ -\infty,\ \infty\}\right]$

$$\frac{1}{4}\left(8\,a+35\,(-1+2\,(-1+a)\,a\,(-7+2\,a))\,b^4-8\,mpr\right)\sqrt{\frac{\pi}{2}}$$

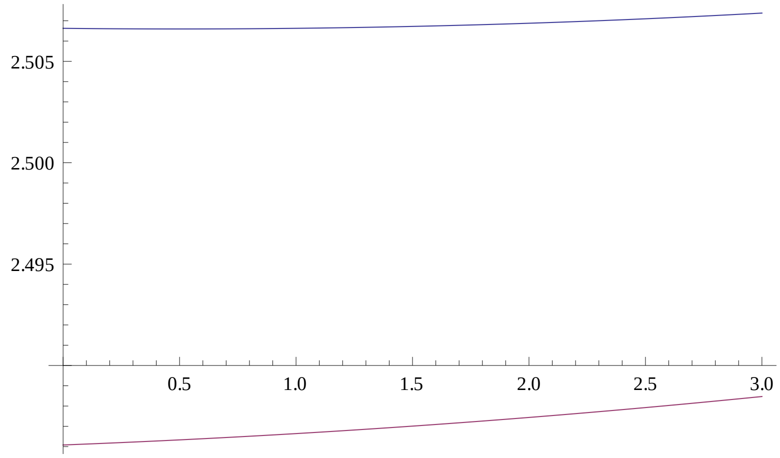
SeriesCoefficient[df[a, w, b, t], {t, 0, 2}]

$$a\,e^{a\left(1-e^{-2.4\,w^2}\right)-5.3\,w^2}\,w^2-\frac{1}{2}\,e^{a\left(1-e^{-2.4\,w^2}\right)-2.9\,w^2}\left(-1+2\,mpr+w^2\right)+\frac{1}{2}\,e^{a\left(1-e^{-2.4\,w^2}\right)-\frac{w^2}{2}}\left(1-e^{-2.4\,w^2}\right)\left(a^2\,e^{-4.8\,w^2}\,w^2-a\,e^{-2.4\,w^2}\left(-1+2\,mpr+w^2\right)\right)$$

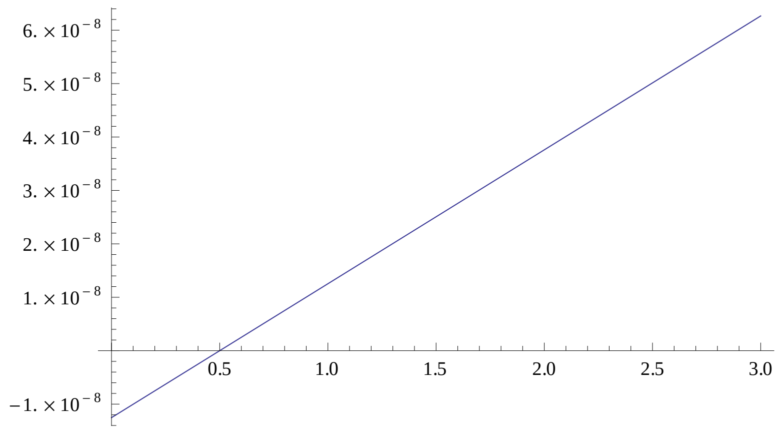
$$\mathbf{\frac{1}{2}\,(-1+2\,a)\,e^{-\frac{w^2}{2}}\,t^2\,w^2-\frac{1}{6}\left(1-6\,a+3\,a^2\right)e^{-\frac{w^2}{2}}\,t^3\,w^3}$$

$$\frac{1}{2}\,(-1+2\,a)\,e^{-\frac{w^2}{2}}\,t^2\,w^2-\frac{1}{6}\left(1-6\,a+3\,a^2\right)e^{-\frac{w^2}{2}}\,t^3\,w^3$$

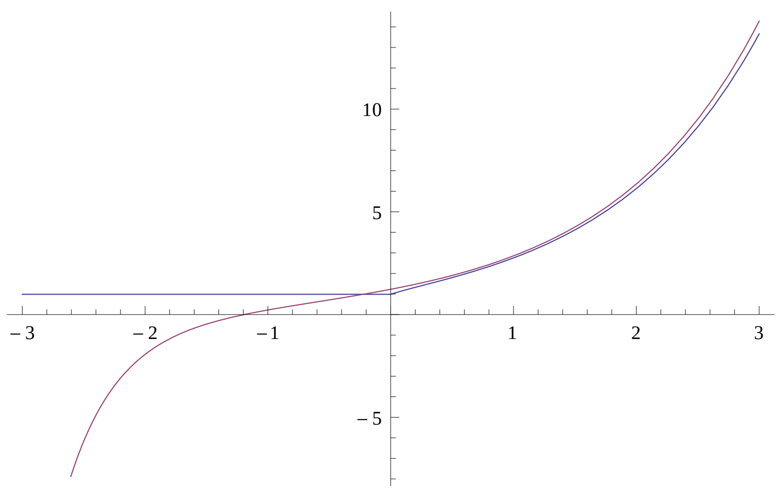
```
ost = .01; mpr = 0.5; b = 2.4; o = -0 3; p = 3; Plot[{g[Max[0, a], ∞], g[a, b]}, {a, o, p}]
```




```
ost = .0001; b = 2.4; o = -1 0; p = 3; Plot[{dg[Max[0, a], ∞]}, {a, o, p}]
```

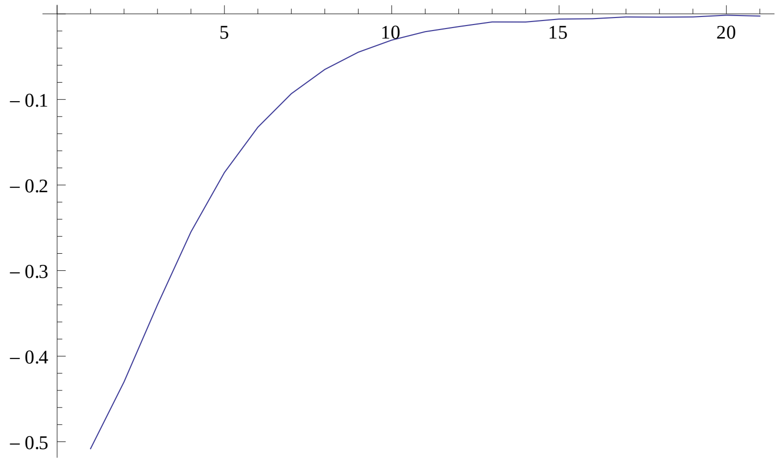



```
b = .1; o = -3; p = 3; Plot[{dg[Max[0, a], 0], dg[a, b]}, {a, o, p}]
```




```
h[b_] := Quiet[FindRoot[dg[a, b] == 0, {a, -5, 5}][[1, 2]]]
```

```
ListLinePlot[Table[h[1 / n / 2], {n, 10, 30}]]
```




```
fcs = Quiet[Table[fc2[n], {n, 650}]];
```

```
ListLinePlot[
 Transpose[Table[{Abs[fcs[[n]]]^(1/n), Abs[fcs[[n + 1]] / fcs[[n]]]}, {n, 1, 600}]]]
```