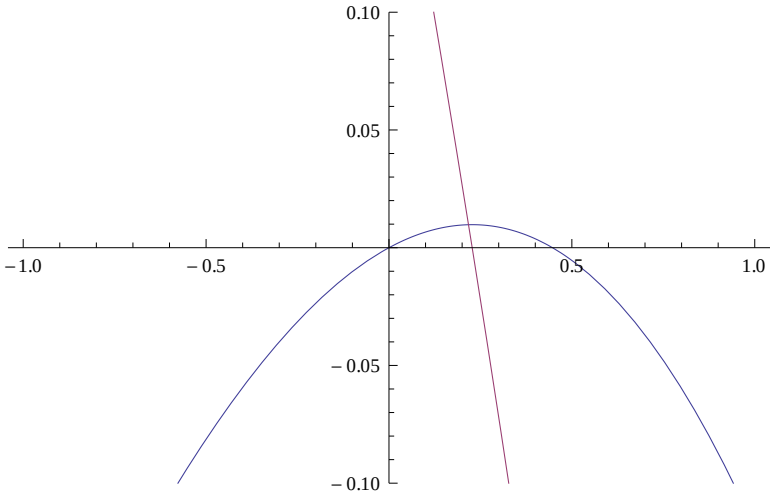
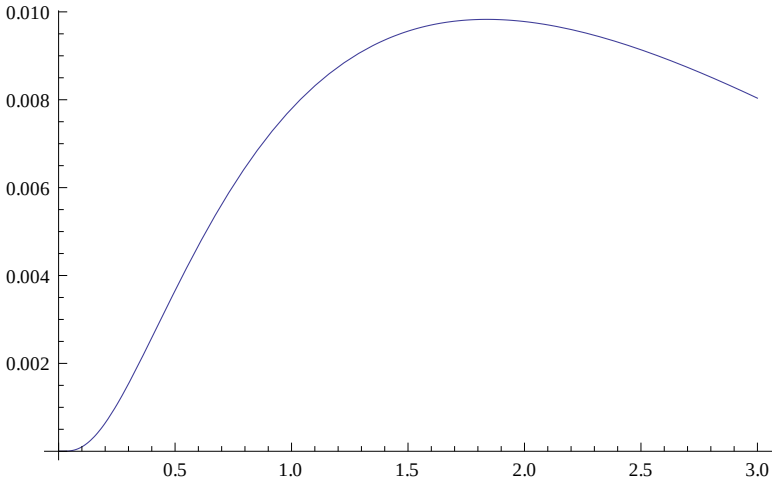
```
Exit[]

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

t == σ √T ; mpr == (μ - r)/σ^2 ; ost =.

xx[W_, mpr_, t_] := Exp[ t W + (mpr - 1 / 2) t^2];
put[k_, t_] := BlackScholesPut[1, k, 1, 0, t, 0]

γ = .1; mpr = 0.1; t = 1;

NIntegrate[Max[0, 1.1 - xx[w, 0, .1]] Exp[-w^2 / 2], {w, -∞, ∞}] / √(2 π) - put[1.1, .1]


pr[a_, k_] :=
  - Log[NIntegrate[Exp[-a Max[0, k - xx[w, mpr, t]] - w^2 / 2], {w, -∞, ∞}] / √(2 π)] -
   a put[k, t];
pr2[a_, k_] := NIntegrate[Exp[-a (Max[0, k - xx[w, mpr, t]] - put[k, t]) - w^2 / 2]
    (Max[0, k - xx[w, mpr, t]] - put[k, t]), {w, -∞, ∞}];

-5.88141 × 10^-14

mpr = -.15; Plot[{pr[a, 2], pr2[a, 2]}, {a, -1, 1}, PlotRange → {-.1, .1}]
```



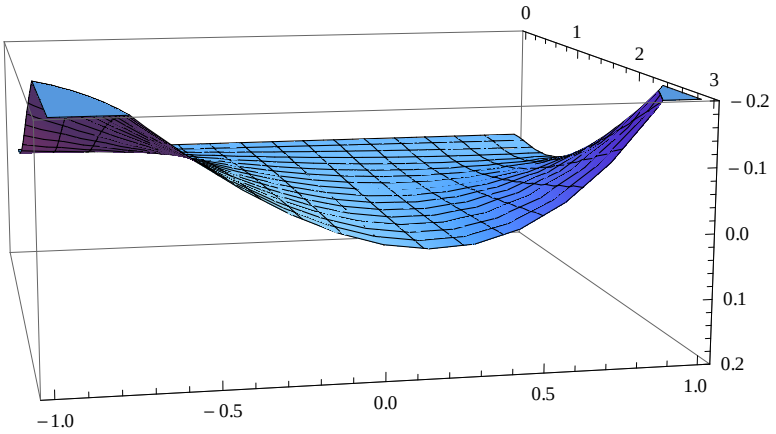
```
mpr = -.15; Plot[{pr[.23, k]}, {k, 0, 3}]
```




```
Quiet[FindRoot[pr2[a, 1.9] == 0, {a, -1, 1}]]
```

$\{a \to 0.23679\}$

```
Plot3D[pr[a, k], {a, -1, 1}, {k, 0, 3}, PlotRange → {-.2, .2}]
```




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

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

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

```
Integrate[, {w, -∞, ∞}]
```

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

```
MinValue[Sqrt[π/2] (2 + a t (2 b + 3 (-1 + a) b^2 t + (a - 2 mpr) t)), {a}]
```

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

```
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[SeriesCoefficient[df[a, w, b Sqrt[t], t], {t, 0, 2}], {w, -∞, ∞}]
```

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

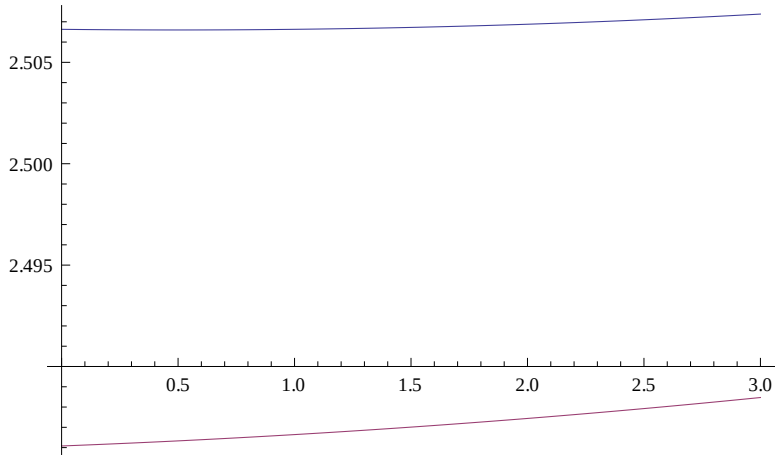
```
SeriesCoefficient[df[a, w, b, t], {t, 0, 2}]
```

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

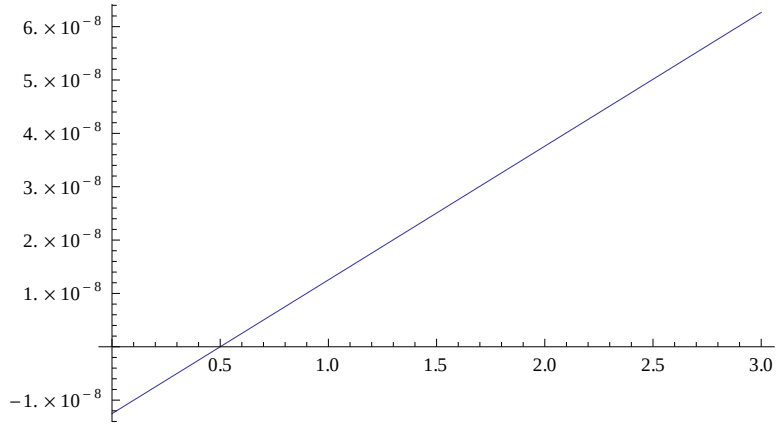
$$\frac{1}{2}(-1 + 2\,a)\,e^{-\frac{w^2}{2}}\,t^2\,w^2 - \frac{1}{6}\left(1 - 6\,a + 3\,a^2\right)e^{-\frac{w^2}{2}}\,t^3\,w^3$$

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

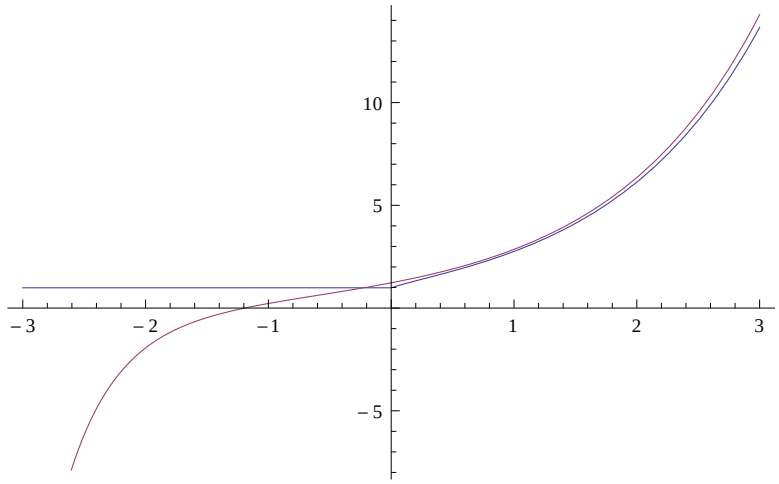
```
ost = .01; mpr = 0.5; b = 2.4; o = -0 3; p = 3; Plot[{g[Max[0, a], ∞], g[a, b]}, {a, o, p}]
```




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

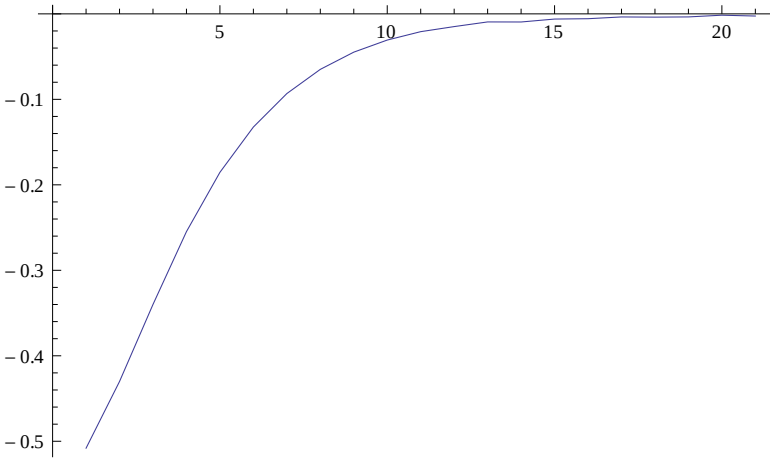



```
b = .1; o = -3; p = 3; Plot[{dg[Max[0, a], 0], dg[a, b]}, {a, o, p}]
```




```
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}]]]
```