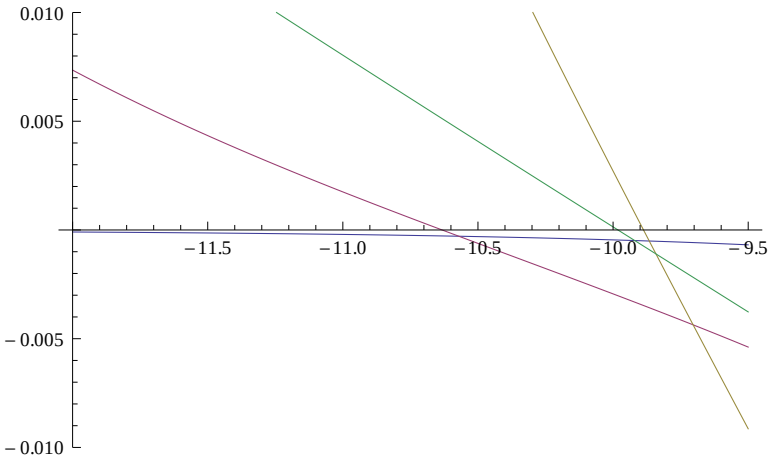
```
Exit[]

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

xx[W_, t_] := Exp[ W + (mpr - 1 / 2) t^2] - 1;

γ = .2; mpr = -0.2;
g[a_, t_, b_] := NIntegrate[Exp[-a xx[w t, t] - w^2 / 2], {w, -b, b}];
f[a_, w_, t_] := Exp[-a xx[w t, t] - w^2 / 2] xx[w t, t]
i[a_, w_, t_] :=
 e^(-a (-1 + e^((-1/2 + mpr) t^2 + t w)) + (-1/2 + mpr) t^2 + t w - w^2/2) (2 (-1/2 + mpr) t + w) -
  a e^(-a (-1 + e^((-1/2 + mpr) t^2 + t w)) + (-1/2 + mpr) t^2 + t w - w^2/2) (-1 + e^((-1/2 + mpr) t^2 + t w)) (2 (-1/2 + mpr) t + w)

i2[a_, w_, t_] := e^(a - a e^(t (-t + w)) - 3 t^2 + t w - w^2/2)
    (a^2 e^(2 t w) (-2 t + w)^2 + (1 + a) e^(2 t^2) (-2 + 4 t^2 - 4 t w + w^2) -
      a e^(t (t + w)) (-2 + 4 (3 + a) t^2 - 4 (3 + a) t w + (3 + a) w^2));
j[a_, t_, b_] := NIntegrate[i[a, w, t], {w, -b, b}];
j2[a_, t_, b_] := NIntegrate[i2[a, w, t], {w, -b, b}];
gs[a_, t_, b_] := NIntegrate[f[a, w, t], {w, -b, b}];
h[a_, w_, t_] := Exp[-a xx[w , t]] xx[w , t] + Exp[-a xx[-w, t]] xx[-w, t]
h2[w_, t_] := Exp[-w^2 / 2 / t^2] / t
gs2[a_, t_, b_] := NIntegrate[h2[w, t] h[a, w, t], {w, 0, t b}]
as[t_, b_] := Quiet[FindRoot[gs[a, t, b] == 0, {a, -1, 0}][[1, 2]]]

b = 5; t = .3; Plot[ {gs[a, t 1.5, b], gs[a, t 1, b], gs[a, t .5, b], gs[a, t .2, b]},
 {a, .95 mpr, 1.2 mpr}, PlotRange → {-.01, .01}]
```




```
as[.1, b]
```

-0.994986

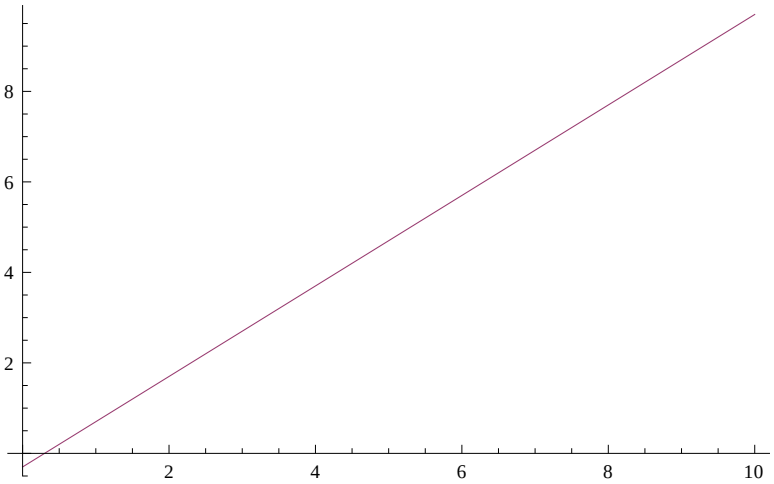
```
gs2[mpr, t, b]
```

0.00216389

```
mpr =.; a =.; t =.; Simplify[(i[a, w, t] + i[a, -w - c, t]) / e^((-1/2 + mpr) t^2)]
```

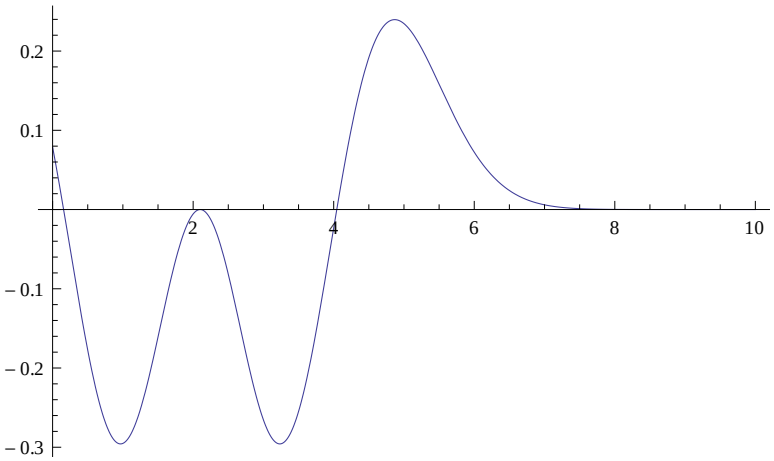
$$e^{a - a\, e^{t\left(-c+\left(-\frac{1}{2}+mpr\right)t-w\right)} - \frac{1}{2}(c+w)(c+2t+w)}\,(-c+(-1+2\,mpr)\,t-w) -$$
$$a\, e^{a - a\, e^{t\left(-c+\left(-\frac{1}{2}+mpr\right)t-w\right)} - \frac{1}{2}(c+w)(c+2t+w)}\left(-1+e^{t\left(-c+\left(-\frac{1}{2}+mpr\right)t-w\right)}\right)(-c+(-1+2\,mpr)\,t-w)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

```
Plot[{-c + (-1 + 2 mpr) t - w, (-1 + 2 mpr) t + w}, {w, 0, 2 b}]
```




```
t = 0.1; mpr = -10; a = mpr; (-1/2 + mpr) t 4
Plot[{i[a, w, t] + i[a, -w + 4.2, t]}, {w, 0, 2 b}, PlotRange → All]
```

-4.2



```
a = -.19901; NIntegrate[
 Exp[-w^2 / 2 / t^2] / t (Exp[-a xx[w , t]] xx[w , t] + Exp[-a xx[-w, t]] xx[-w, t])
 , {w, 0, t b}]
```

-1.70561×10^{-8}

```
mpr =.;
```

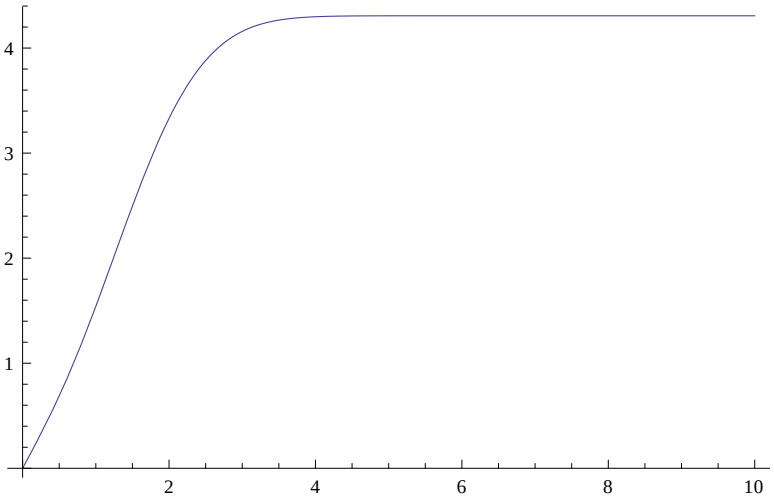
```
ds = Table[as[1 / n, b / n], {n, 1, 60}]
```

{-0.0525742, -0.154073, -0.458295, -0.948096, -1.59442, -2.38981, -3.33203,
 -4.42028, -5.6542, -7.03363, -8.55848, -10.2287, -12.0442, -14.0051, -16.1112,
 -18.3626, -20.7594, -23.3014, -25.9886, -28.8212, -31.799, -34.922, -38.1904,
 -41.604, -45.1629, -48.867, -52.7164, -56.7111, -60.851, -65.1362, -69.5666,
 -74.1424, -78.8633, -83.7296, -88.7411, -93.8979, -99.1999, -104.647,
 -110.24, -115.978, -121.861, -127.889, -134.063, -140.381, -146.846, -153.455,
 -160.21, -167.109, -174.155, -181.345, -188.681, -196.162, -203.788,
 -211.559, -219.476, -227.538, -235.745, -244.098, -252.596, -261.239}

```
Integrate[xx[w, 1] Exp[-w^2 / 2], {w, -b, b}]
```

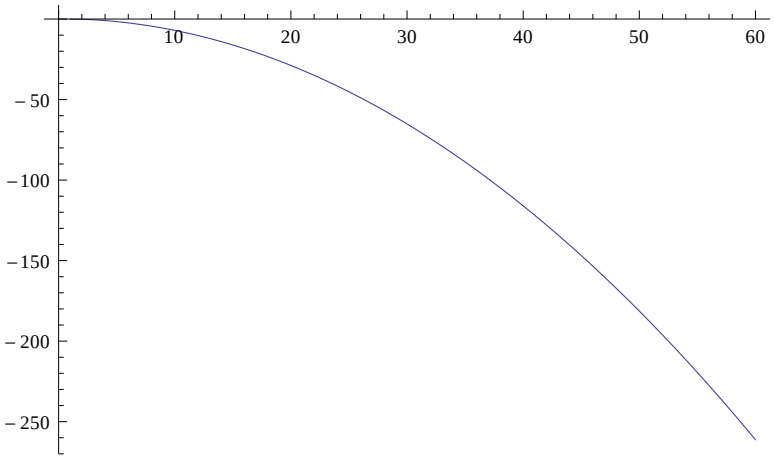
$$\sqrt{\frac{\pi}{2}} \left(-2\,\text{Erf}\left[\frac{b}{\sqrt{2}}\right] + e^{mpr}\left(\text{Erf}\left[\frac{-1+b}{\sqrt{2}}\right] + \text{Erf}\left[\frac{1+b}{\sqrt{2}}\right]\right)\right)$$

```
mpr = 2 / 2; Plot[Sqrt[π/2] (-2 Erf[b/Sqrt[2]] + e^mpr (Erf[(-1+b)/Sqrt[2]] + Erf[(1+b)/Sqrt[2]])), {b, 0, 10}]
```




```
Exit[]
```

```
ListLinePlot[ds, PlotRange → All]
```



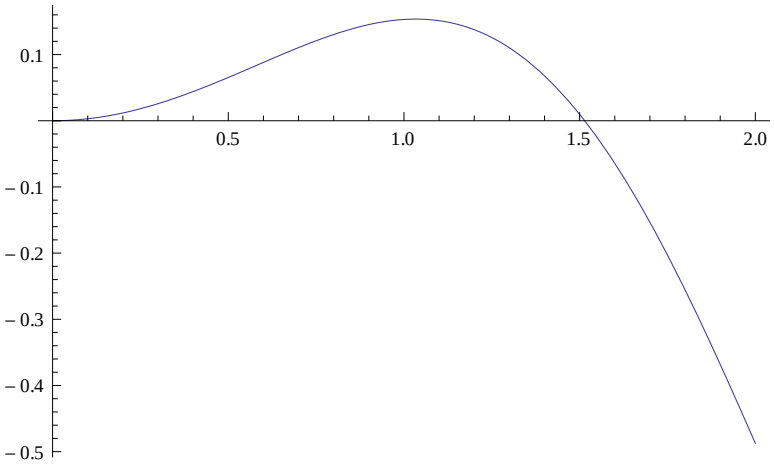

```
gs2[a_, t_] := NIntegrate[Exp[-a (Exp[- t w] - 1) - w^2 / 2] (1 - Exp[- t w]) +
    Exp[-a (Exp[ t w] - 1) - w^2 / 2] (1 - Exp[ t w]), {w, 0, ∞}];
```

```
Integrate[Exp[t w - w^2 / 2], {w, -∞, ∞}]
```

$$e^{\frac{t^2}{2}} \sqrt{2\pi}$$

```
h[w_] := Exp[-a (Exp[w] - 1)] (Exp[w] - 1)
```

```
a = .7 / 2; Plot[h[x] + h[-x] /. x → w, {w, 0, 2}, PlotRange → All]
```

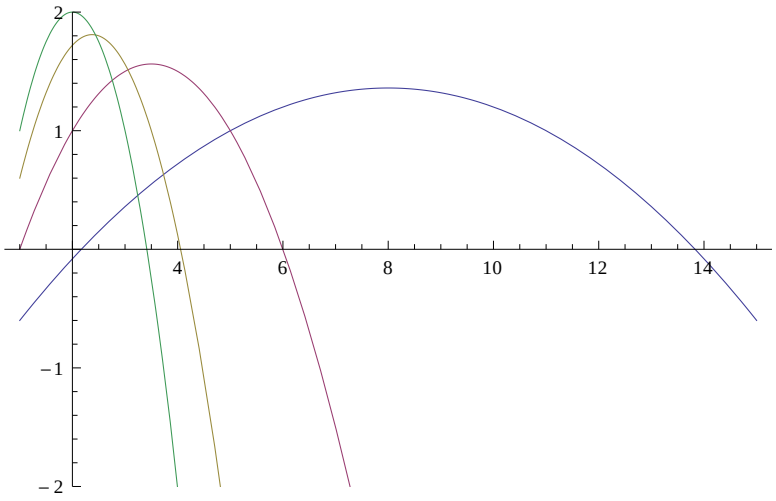


```
ie[s_, a_] := (a (s - 1) - 1) + (2 a - a^2 (s - 1)) s
a /. Solve[0 == ie[s, a], a]
Limit[#, {s → 1}] & /@ %
```

$$\left\{\frac{-1+3\,s-\sqrt{1-2\,s+5\,s^2}}{2\left(-s+s^2\right)},\ \frac{-1+3\,s+\sqrt{1-2\,s+5\,s^2}}{2\left(-s+s^2\right)}\right\}$$

$$\left\{\left\{\frac{1}{2}\right\},\ \{\infty\}\right\}$$

```
asd = Simplify[Table[ie[s, a], {a, {.2, 1 / 2, .8, 1}}]];
Plot[asd, {s, 1, 15}, PlotRange → {-2, 2}]
```




```
u[s_] := -Exp[-a (s - 1)] (s - 1)

D[u[s], {s, 1}]
D[u[s], {s, 2}]
```

$$-e^{-a\left(-1+s\right)}+a\,e^{-a\left(-1+s\right)}\left(-1+s\right)$$

```
Simplify[D[Exp[-w^2 / 2 / t^2] / t, t]]
```

$$\frac{e^{-\frac{w^2}{2\,t^2}}\left(-t^2+w^2\right)}{t^4}$$