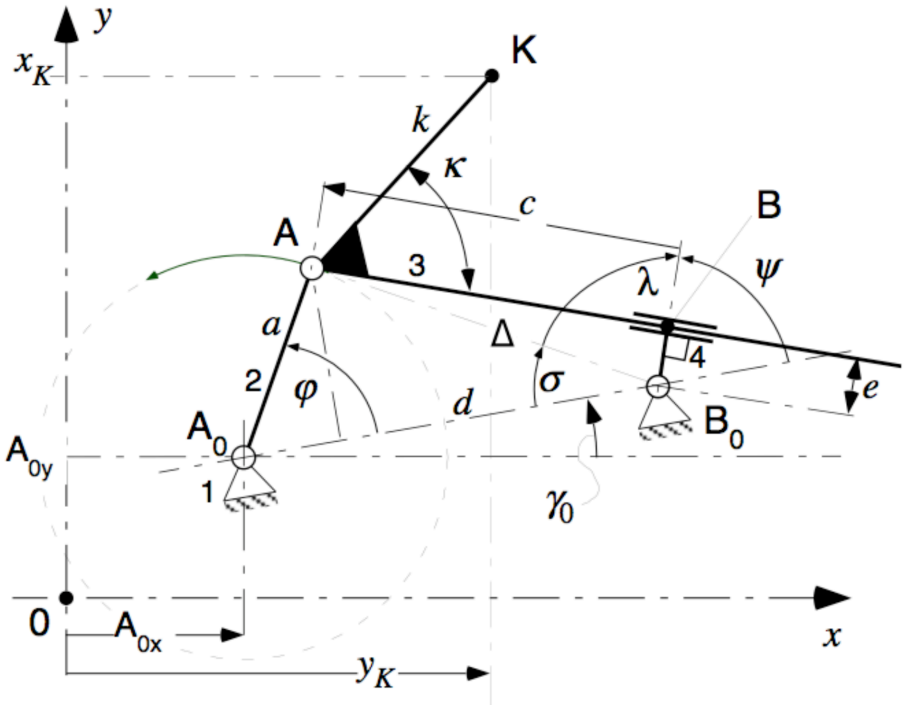
Eccentric Crank-Shaper Mechanisms - Table 2-13

```
<< Version5`Graphics`
```

```
Get::noopen : Cannot open Version5`Graphics` . Mehr…
```

```
$Failed
```




```
Clear[par, φ, ψ, ψ1, ψ2, φ0, ψ0, a, b, c, d];
```

```
par1 = {a → 18, d → 38, e → 5, k → 24, ϰ → 55 Degree, A0x → 0, A0y → 0, γ0 → 0}
```

```
{a → 18, d → 38, e → 5, k → 24, ϰ → 55 °, A0x → 0, A0y → 0, γ0 → 0}
```

■ crank-shaper mechanismus: Basic functions

```
σ = ArcTan[a Sin[φ]/(d-a Cos[φ])]
Δ = Simplify[Sqrt[(a Sin[φ])^2 + (d-a Cos[φ])^2]]
λ = Simplify[ArcCos[e / Δ] ]
fψ = π - (σ + λ)
```

$$\text{ArcTan}\left[\frac{a \text{Sin}[\varphi]}{d - a \text{Cos}[\varphi]}\right]$$

$$\sqrt{a^2 + d^2 - 2\, a\, d \text{Cos}[\varphi]}$$

$$\text{ArcCos}\left[\frac{e}{\sqrt{a^2 + d^2 - 2\, a\, d \text{Cos}[\varphi]}}\right]$$

$$\pi - \text{ArcCos}\left[\frac{e}{\sqrt{a^2 + d^2 - 2\, a\, d \text{Cos}[\varphi]}}\right] - \text{ArcTan}\left[\frac{a \text{Sin}[\varphi]}{d - a \text{Cos}[\varphi]}\right]$$

```
fc = Sqrt[Δ^2 - e^2]
```

$$\sqrt{a^2 + d^2 - e^2 - 2\, a\, d \text{Cos}[\varphi]}$$

```
my = 3 / 2 Pi - φ - σ - λ
```

$$\frac{3\,\pi}{2} - \varphi - \text{ArcCos}\left[\frac{e}{\sqrt{a^2 + d^2 - 2\, a\, d \text{Cos}[\varphi]}}\right] - \text{ArcTan}\left[\frac{a \text{Sin}[\varphi]}{d - a \text{Cos}[\varphi]}\right]$$

```
fctmy[f_] := If[Abs[f] > Pi / 2, Pi - Abs[f], Abs[f]];
```

```
xK = A0x + a Cos[φ + γ0] + k Cos[ϰ + γ0 - Pi / 2 + ψ]
yK = A0y + a Sin[φ + γ0] + k Sin[ϰ + γ0 - Pi / 2 + ψ]
```

$$\text{A0x} + a \text{Cos}[\gamma 0 + \varphi] + k \text{Sin}[\gamma 0 + \varkappa + \psi]$$

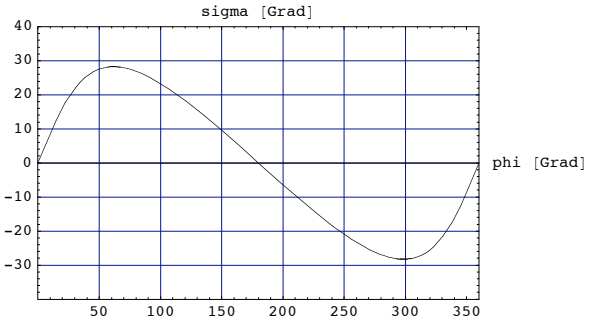
$$\text{A0y} - k \text{Cos}[\gamma 0 + \varkappa + \psi] + a \text{Sin}[\gamma 0 + \varphi]$$

■ Evaluations

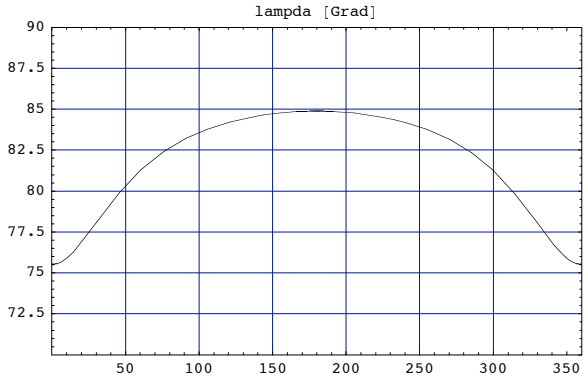
```
fψ / . par1 /.
```

$$\frac{\pi - \text{ArcCos}\left[\frac{5}{\sqrt{1768-1368\,\text{Cos}[\varphi]}}\right] - \text{ArcTan}\left[\frac{18\,\text{Sin}[\varphi]}{38-18\,\text{Cos}[\varphi]}\right]}{\circ}$$

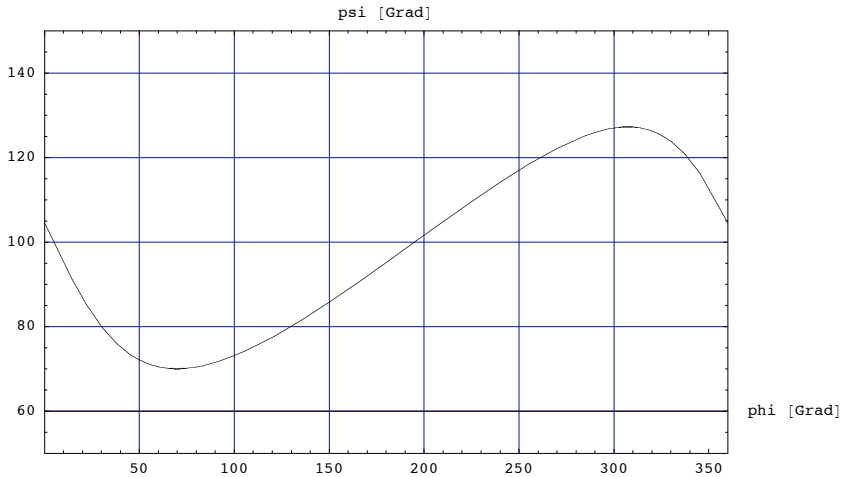
```
φ = phiG * Degree;
Plot[σ / . par1, {phiG, 0, 360}, Frame → True, GridLines → Automatic,
  AxesLabel → {"phi [Grad]", None}, PlotLabel → "sigma [Grad]", PlotRange → {{0, 360}, {-40, 40}}];
φ =.;
```




```
φ = phiG * Degree;
Plot[λ / . par1, {phiG, 0, 360}, Frame → True, GridLines → Automatic,
  AxesLabel → {"phi [Grad]", None}, PlotLabel → "lampda [Grad]", PlotRange → {{0, 360}, {70, 90}}];
φ =.;
```



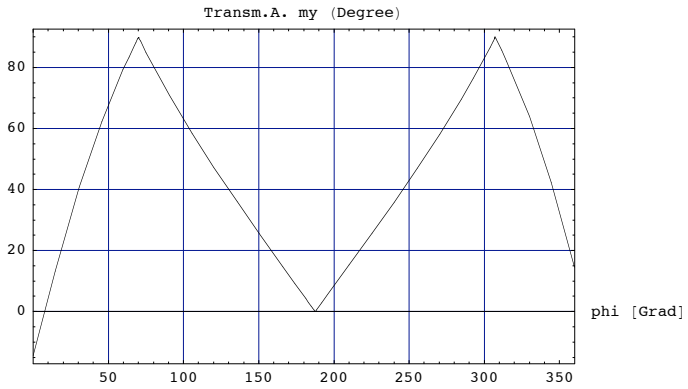

```
φ = phiG * Degree;
Plot[fψ / . par1, {phiG, 0, 360}, Frame → True, GridLines → Automatic,
  AxesLabel → {"phi [Grad]", None}, PlotLabel → "psi [Grad]", PlotRange → {{0, 360}, {50, 150}}];
φ =.;
```



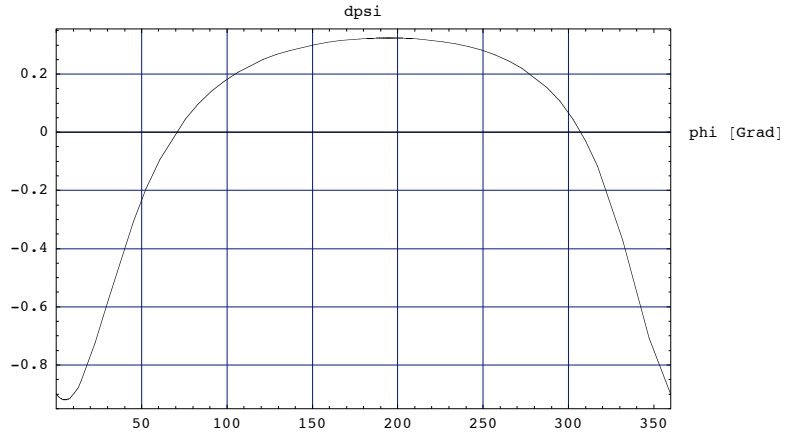
```
fctmy[my /. par1 /. φ → 0] // N
```

```
-0.25268
```

```
φ = phiG * Degree;
Plot[fctmy[my /. par1] / Degree, {phiG, 0, 360}, Frame → True, GridLines → Automatic,
  AxesLabel → {"phi [Grad]", None}, PlotLabel → "Transm.A. my (Degree)", PlotRange → {{0, 360}, Automatic}];
φ =.;
```




```
dfψ = D[fψ, φ];
φ = phiG * Degree;
Plot[dfψ /. par1, {phiG, 0, 360}, Frame → True, GridLines → Automatic,
  AxesLabel → {"phi [Grad]", None}, PlotLabel → "dpsi", PlotRange → {{0, 360}, Automatic}];
φ =.;
```




```
erg1 = Solve[(dfψ /. par1) == 0, φ] // N
```

```
{{φ → 1.22164}, {φ → -0.9207}}
```

```
phierg = φ / Degree /. erg1[[1]]
```

```
69.9948
```

```
fψ / Degree /. par1 /. φ -> phierg Degree
```

```
69.9948
```

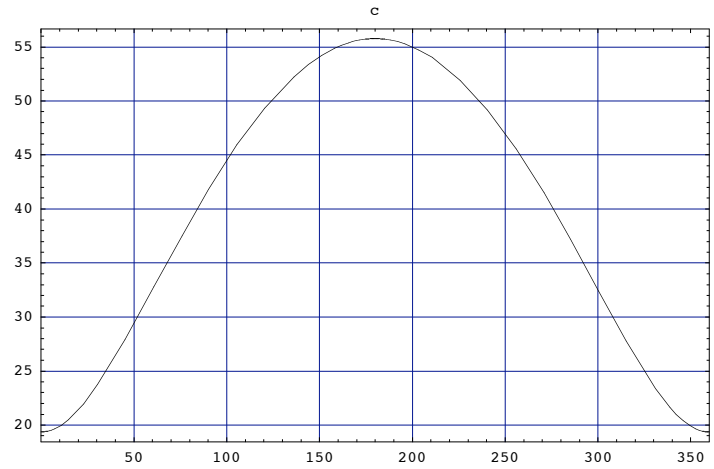
```
phierg = (2 Pi + φ) / Degree /. erg1[[2]]
```

```
307.248
```

```
fψ / Degree /. par1 /. φ -> phierg Degree
```

```
127.248
```

```
φ = phiG * Degree;
Plot[fc /. par1, {phiG, 0, 360}, Frame → True, GridLines → Automatic,
  AxesLabel → {"phi [Grad]", None}, PlotLabel → "c", PlotRange → {{0, 360}, Automatic}];
φ =.;
```




```
fc
```

$$\sqrt{a^2 + d^2 - e^2 - 2\,a\,d\,\text{Cos}[\varphi]}$$

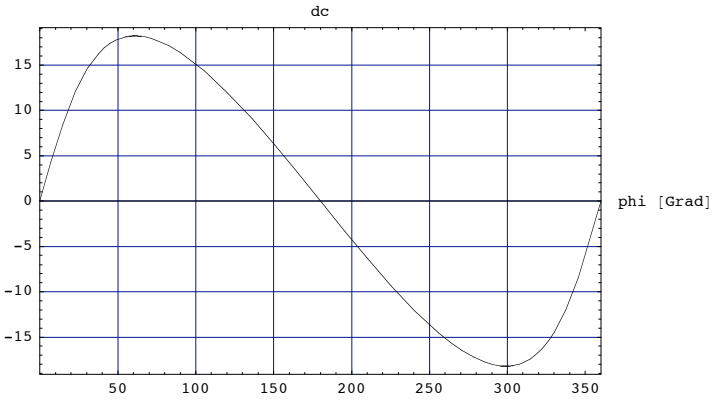
```
dfc = D[fc, φ]
```

$$\frac{a\,d\,\text{Sin}[\varphi]}{\sqrt{a^2 + d^2 - e^2 - 2\,a\,d\,\text{Cos}[\varphi]}}$$

```
dfc /. φ → 0
```

```
0
```

```
φ = phiG * Degree;
Plot[dfc /. par1, {phiG, 0, 360}, Frame → True, GridLines → Automatic,
  AxesLabel → {"phi [Grad]", None}, PlotLabel → "dc", PlotRange → {{0, 360}, Automatic}];
φ =.;
```




```
erg1 = FindRoot[(dfc /. par1) == 0, {φ, Pi}]
```

```
{φ → 3.14159}
```

```
phierg = φ / Degree /. erg1[[1]]
```

```
180.
```

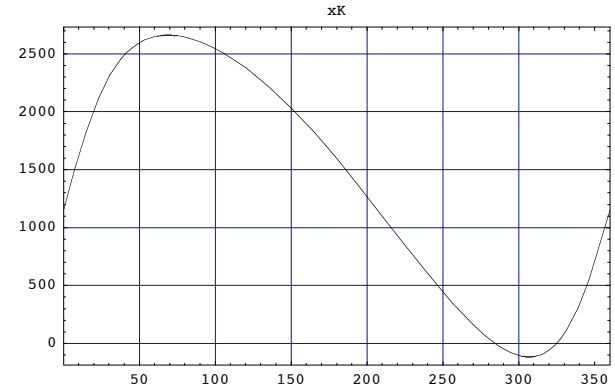
```
fc /. par1 /. φ -> phierg Degree
```

```
55.7763
```

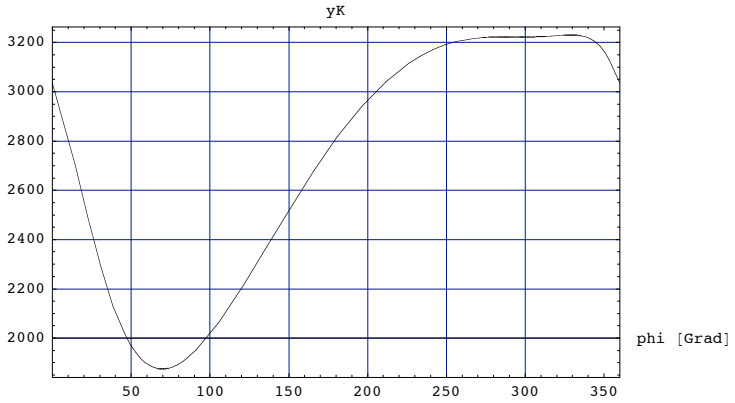
```
xK /. ψ → fψ /. par1
```

$$18\,\text{Cos}[\varphi] - 3240\,\text{Sin}\left[55\,° - \text{ArcCos}\left[\frac{5}{\sqrt{1768 - 1368\,\text{Cos}[\varphi]}}\right] - \text{ArcTan}\left[\frac{18\,\text{Sin}[\varphi]}{38 - 18\,\text{Cos}[\varphi]}\right]\right]$$

```
φ = phiG * Degree;
Plot[xK /. ψ → fψ /. par1, {phiG, 0, 360}, Frame → True, GridLines → Automatic,
  AxesLabel → {"phi [Grad]", None}, PlotLabel → "xK", PlotRange → {{0, 360}, Automatic}];
φ =.;
```




```
φ = phiG * Degree;
Plot[yK /. ψ → fψ /. par1, {phiG, 0, 360}, Frame → True, GridLines → Automatic,
  AxesLabel → {"phi [Grad]", None}, PlotLabel → "yK", PlotRange → {{0, 360}, Automatic}];
φ =.;
```




```
xKpar = xK /. ψ → fψ /. par1;
yKpar = yK /. ψ → fψ /. par1;
plo1 = ParametricPlot[{xKpar, yKpar}, {φ, 0, 2 Pi}, PlotRange → {{-10, 40}, {-0, 40}},
   Frame → True, GridLines → Automatic, PlotLabel → "Path of K in x-y-frame ", AspectRatio → Automatic];
```