planex2d

CAD exercises

Dimensioned drawings of 2D and 3D parts to model in planex2d or in any CAD system

Each sheet holds one part at the scale given in its title strip. Printed at actual size (100 %, not fitted to the page), the drawing can be measured on the paper. Every exercise has a solution in planex2d and the values to check a model against on its page at planex2d.org/docs/exercises/.

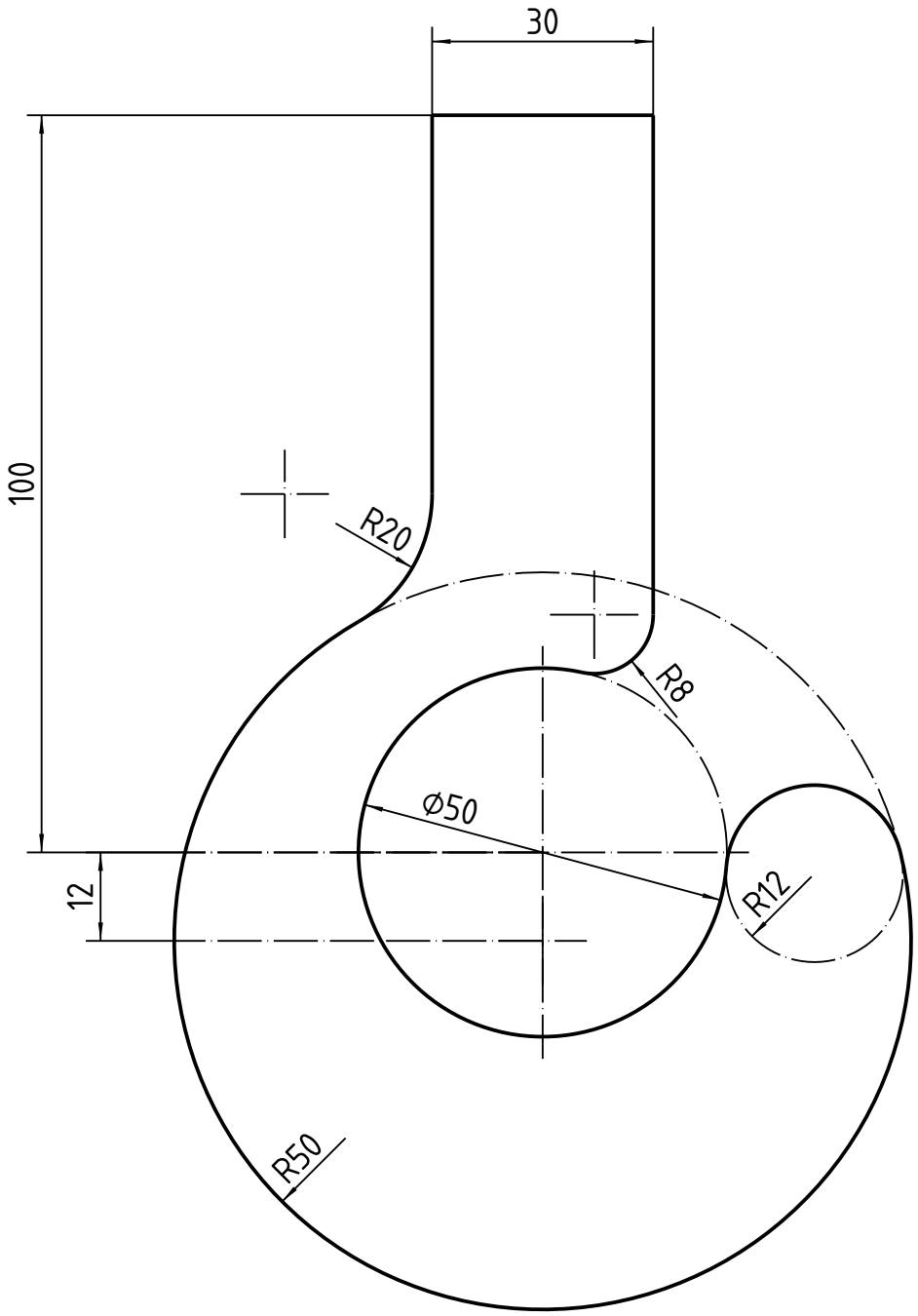
2D exercises

01	Crane hook	2
02	Lever	3
03	Flange gasket	4
04	Lobed gasket	5
05	Chain link plate	6
06	Keyed hub	7
07	Circular-arc cam	8
08	Bell crank	9
09	Vent plate	10
10	Adjusting plate	11
11	Nut retainer	12
12	Wall hanger	13
13	Motor mount plate	14
14	Spring clip	15
15	Ratchet wheel	16
16	Open-end spanner	17
17	Lifting lug	18
18	Ratchet pawl	19
19	Chain sprocket	20
20	Disc cam	21
21	Flange series	22
22	Gear pump gasket	23

3D exercises

01	Pillow block	24
02	Guide block	25
03	Angle bracket	26
04	Step block	27
05	Inclined block	28
06	V-belt pulley	29
07	Corner block	30
08	Column base	31
09	Clevis	32
10	Fork lever	33
11	Rocker	34
12	Saddle support	35
13	Stepped shaft	36
14	Spur gear	37
15	Impeller	38
16	Square-to-round transition	39
17	Elbow duct	40
18	Impeller with twisted blades	41
19	Hex standoff	42
20	Control knob	43
21	Split shaft collar	44
22	Electronics enclosure	45
23	Connecting rod	46
24	Manifold block	47
25	Sheet-metal bracket	48
26	Compression spring	49
27	Pipe flange	50
28	Handwheel	51
29	Gear pump cover	52
30	Gear pump housing	53
31	Gear pump rotors	54

© 2026 Sebastian Hirnschall. The exercises are under CC BY-NC-SA 4.0, with an additional permission to use them in teaching for which a fee is charged; see planex2d.org/docs/core/notices.html. The name planex2d and its logo are not covered by these licenses.



Crane hook

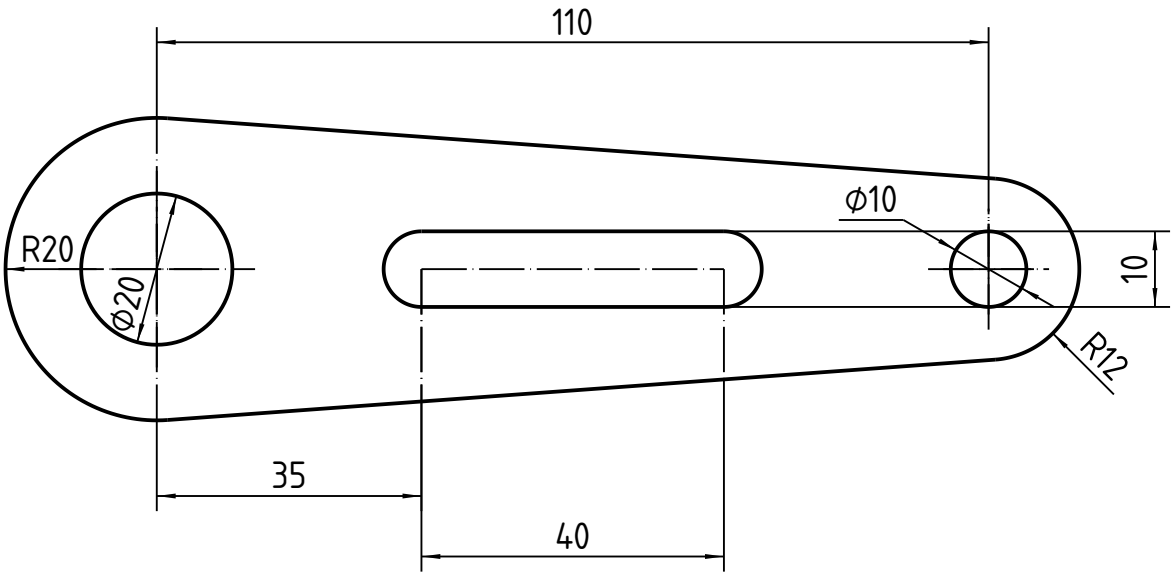
2D exercise 01

planex2d.org/docs/exercises

Scale 1:1

Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Lever

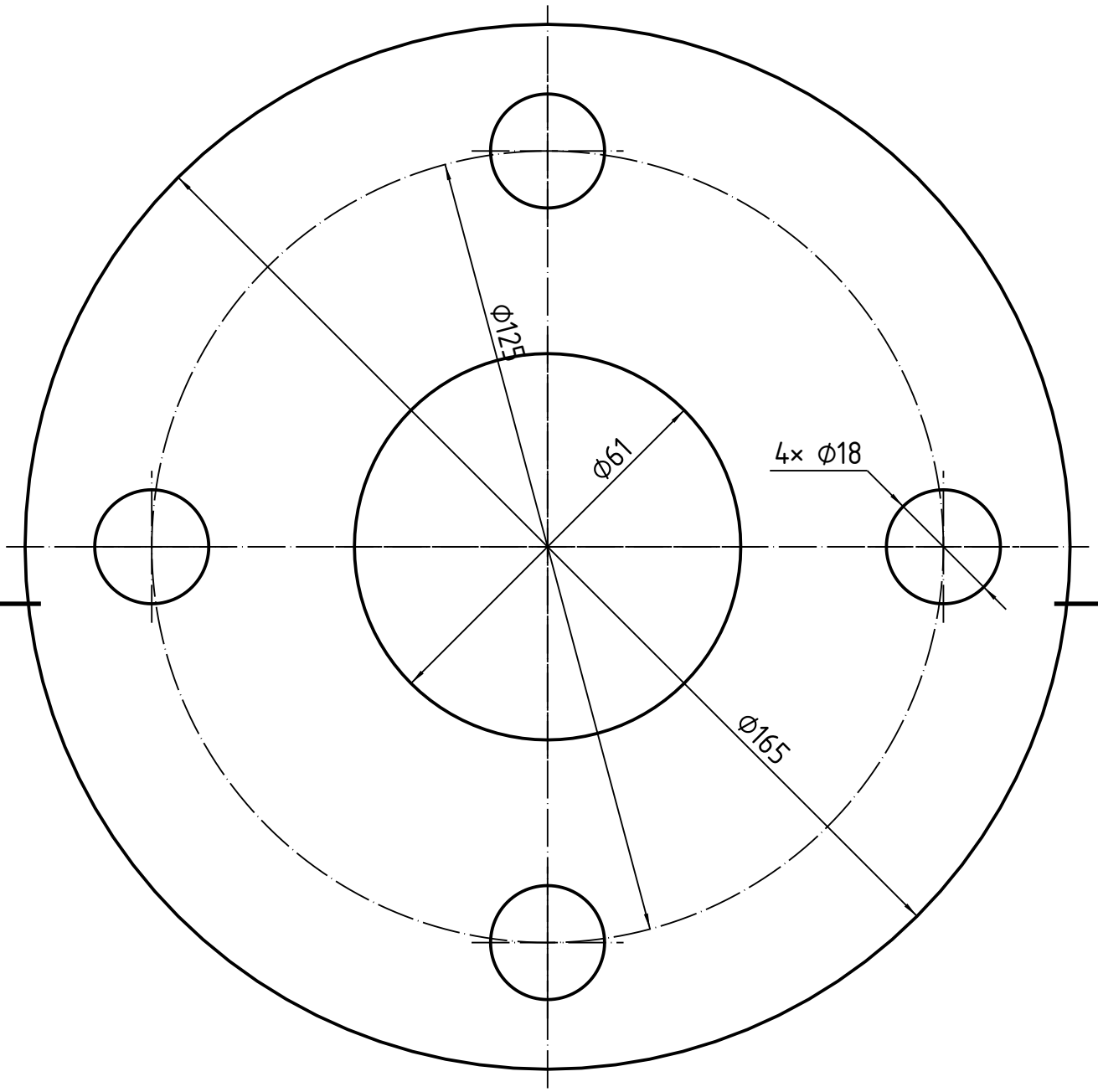
2D exercise 02

planex2d.org/docs/exercises

Scale 1:1

Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Flange gasket

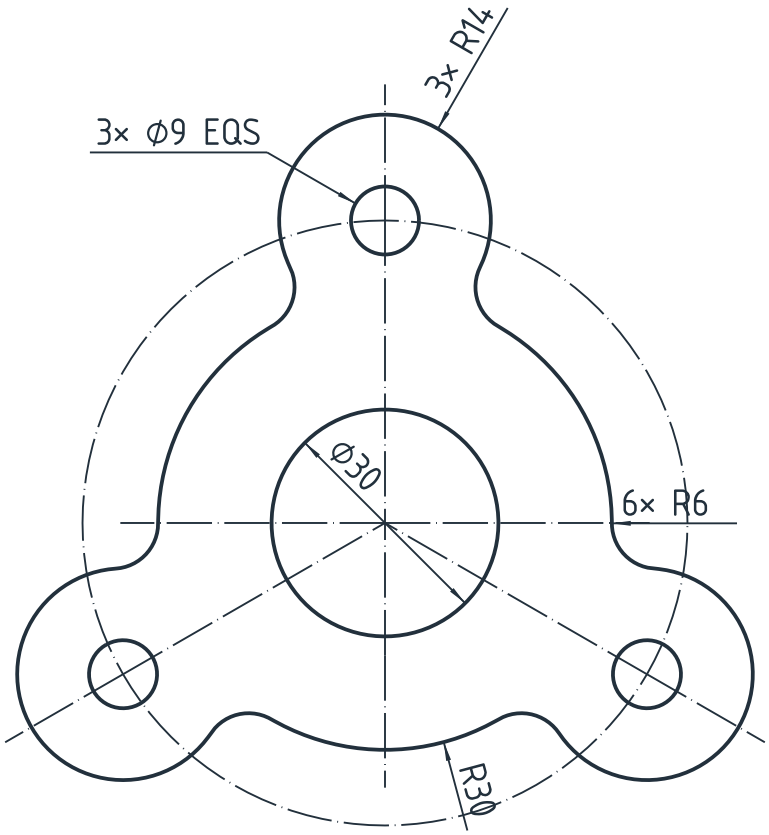
2D exercise 03

planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Scale 1:1

Print at 100 %



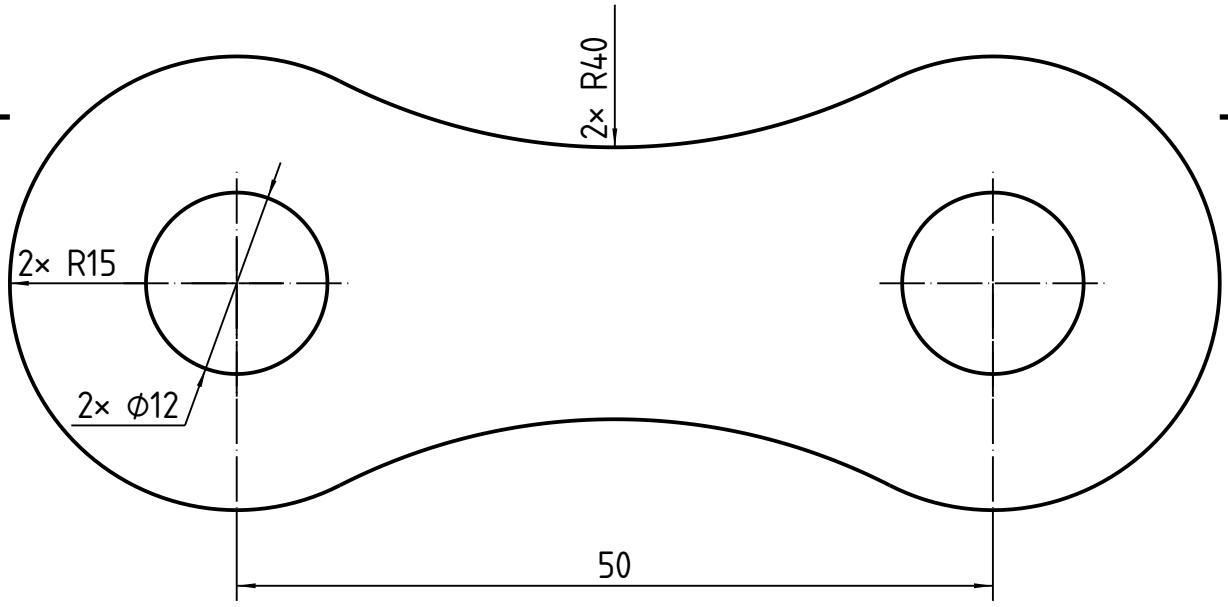
Lobed gasket

Scale 1:1

2D exercise 04 · planex2d.org/docs/exercises/lobed-gasket.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Chain link plate

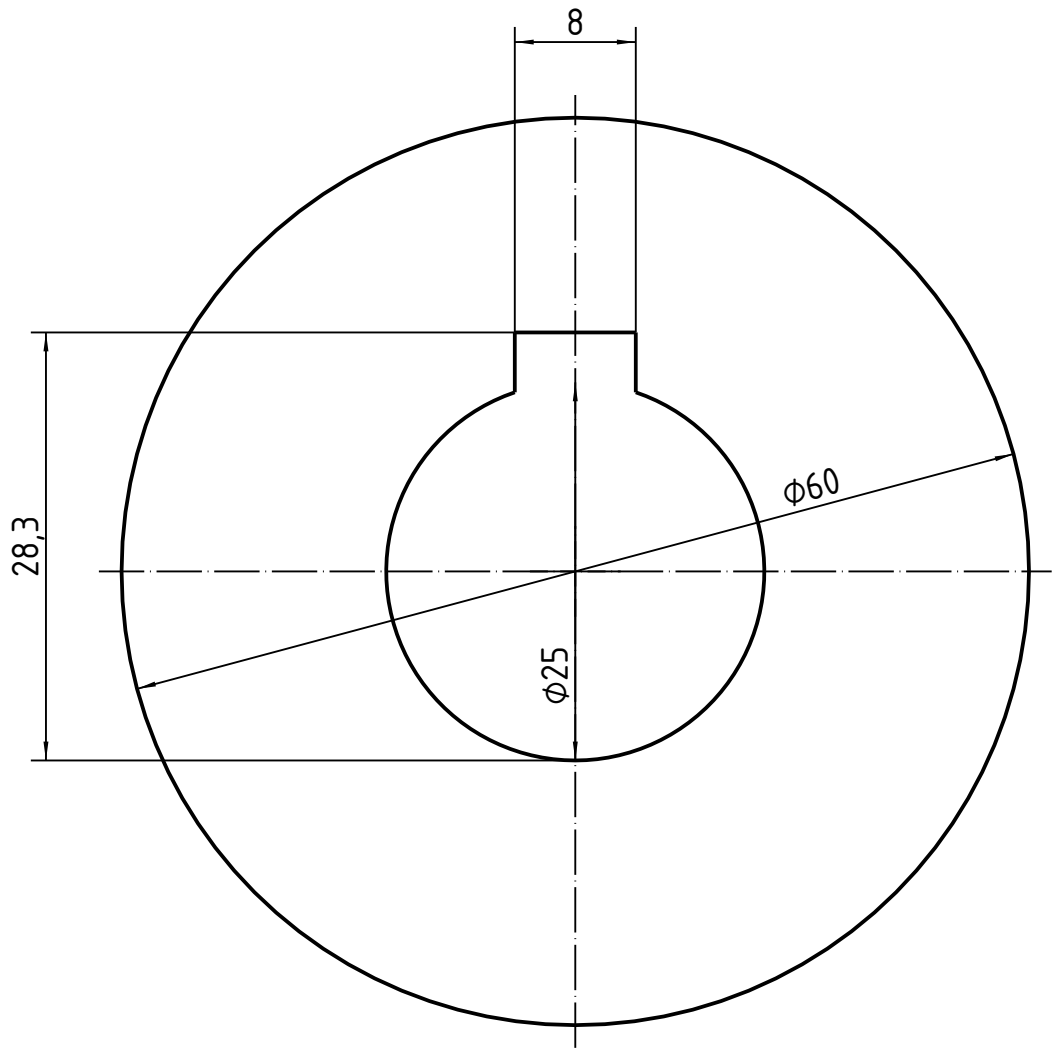
2D exercise 05

planex2d.org/docs/exercises

Scale 2:1

Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Keyed hub

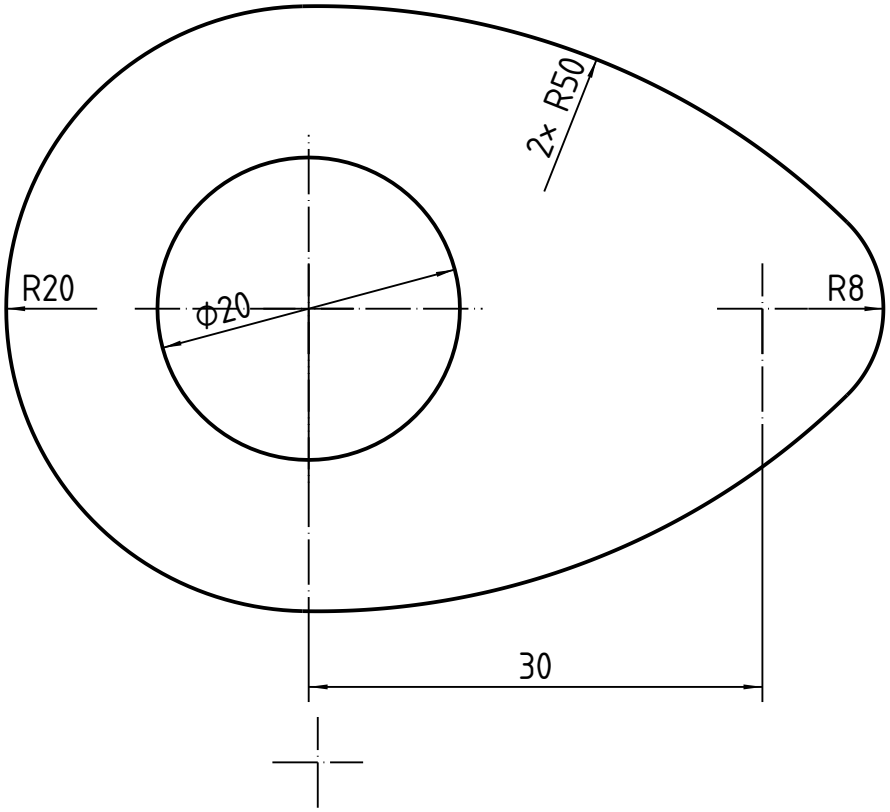
2D exercise 06

planex2d.org/docs/exercises

Scale 2:1

Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Circular-arc cam

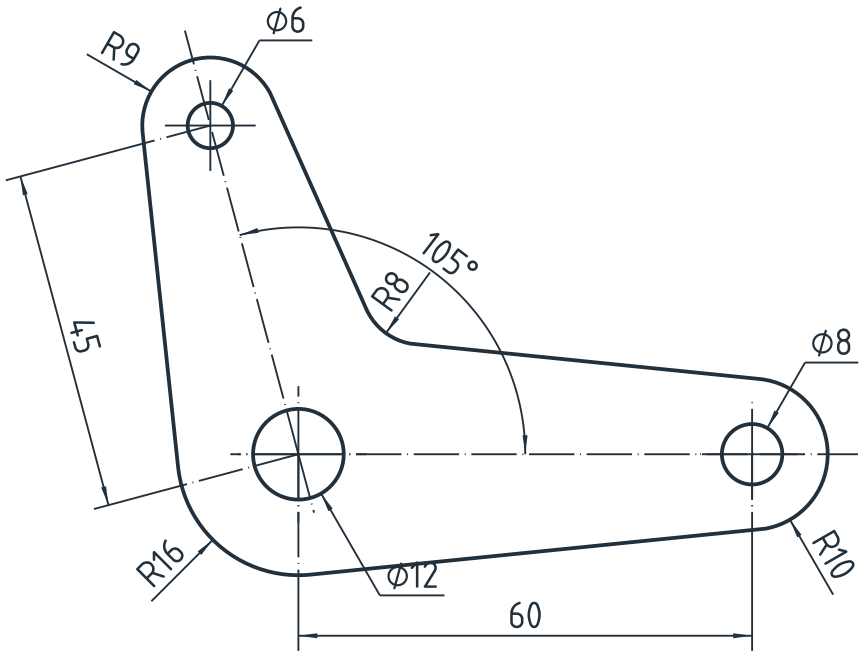
2D exercise 07

planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Scale 2:1

Print at 100 %



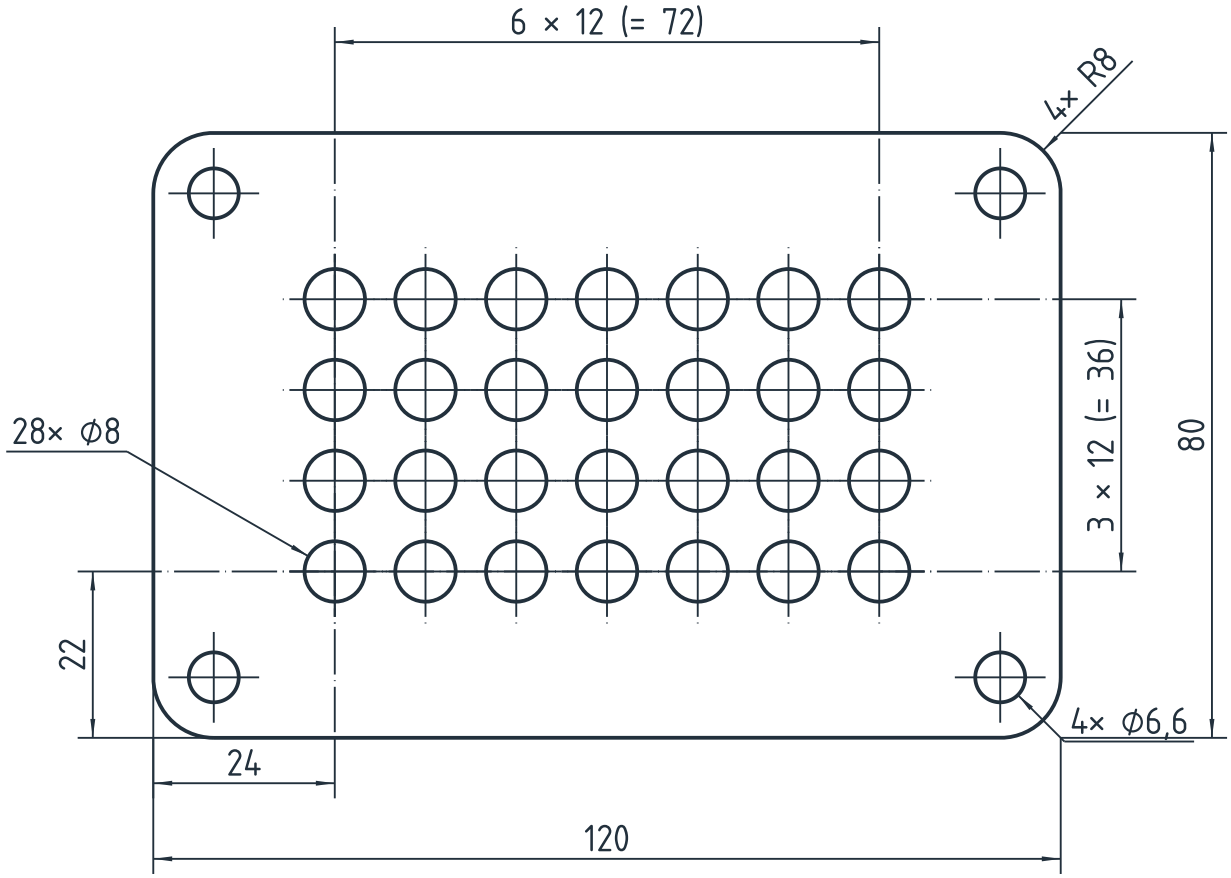
Bell crank

Scale 1:1

2D exercise 08 · planex2d.org/docs/exercises/bell-crank.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



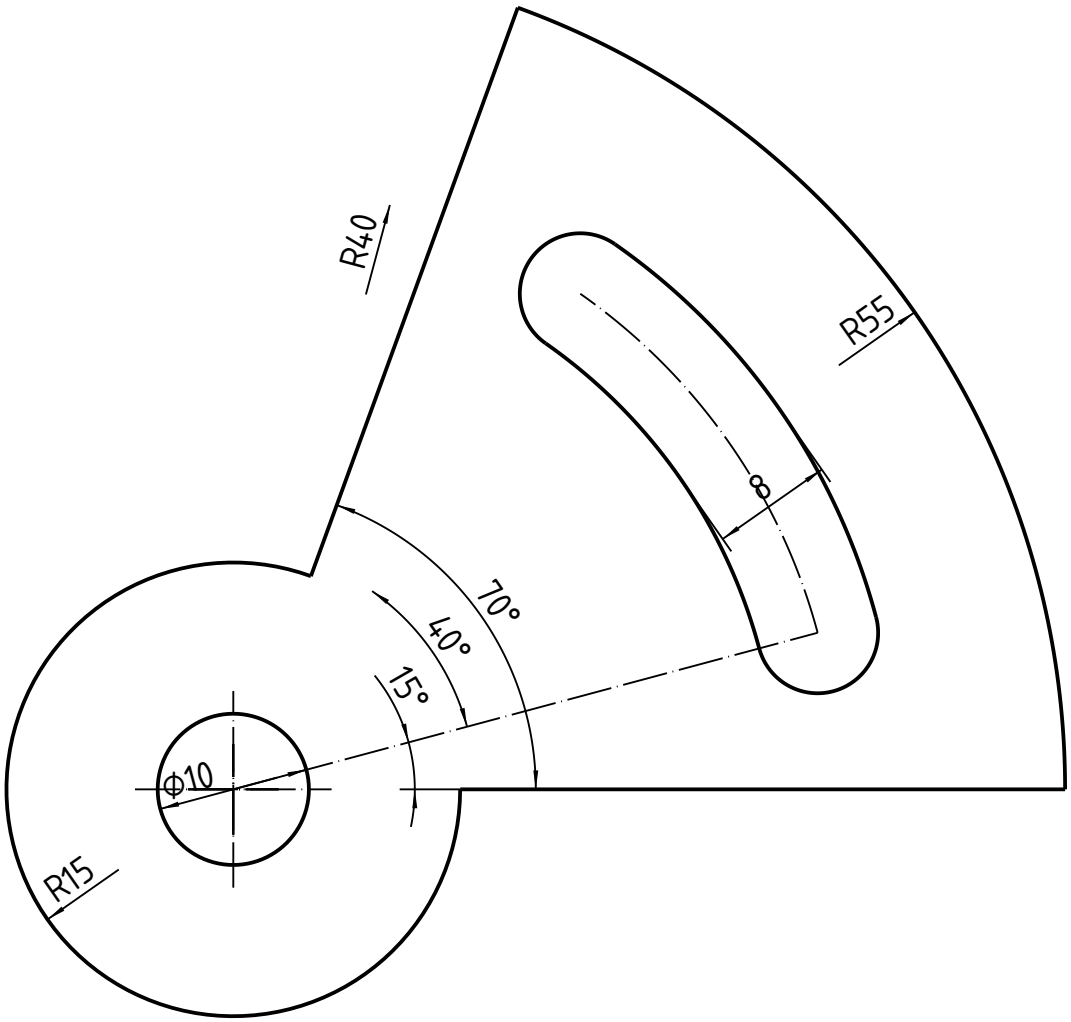
Vent plate

Scale 1:1

2D exercise 09 · planex2d.org/docs/exercises/vent-plate.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Adjusting plate

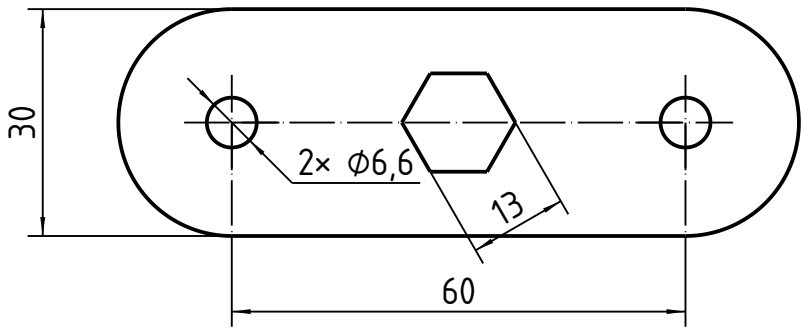
2D exercise 10

planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Scale 2:1

Print at 100 %



Nut retainer

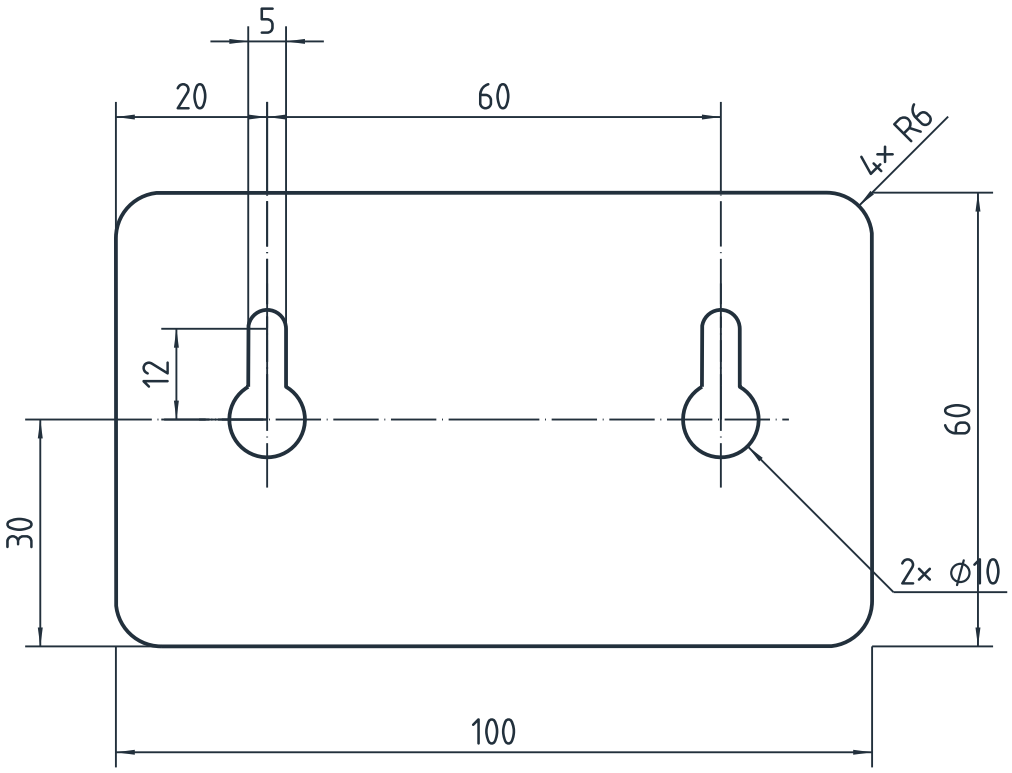
2D exercise 11

planex2d.org/docs/exercises

Scale 1:1

Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



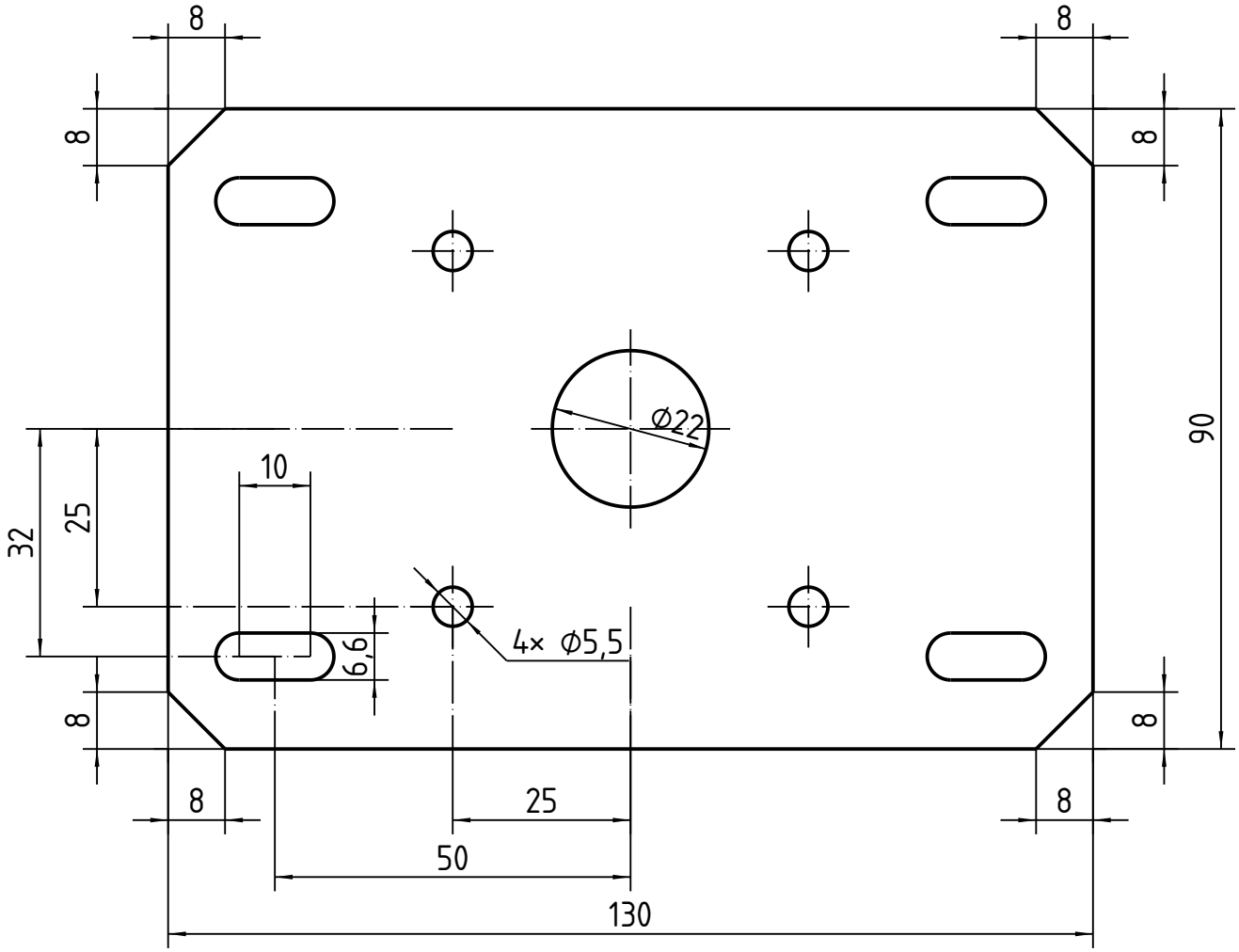
Wall hanger

Scale 1:1

2D exercise 12 · planex2d.org/docs/exercises/wall-hanger.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Motor mount plate

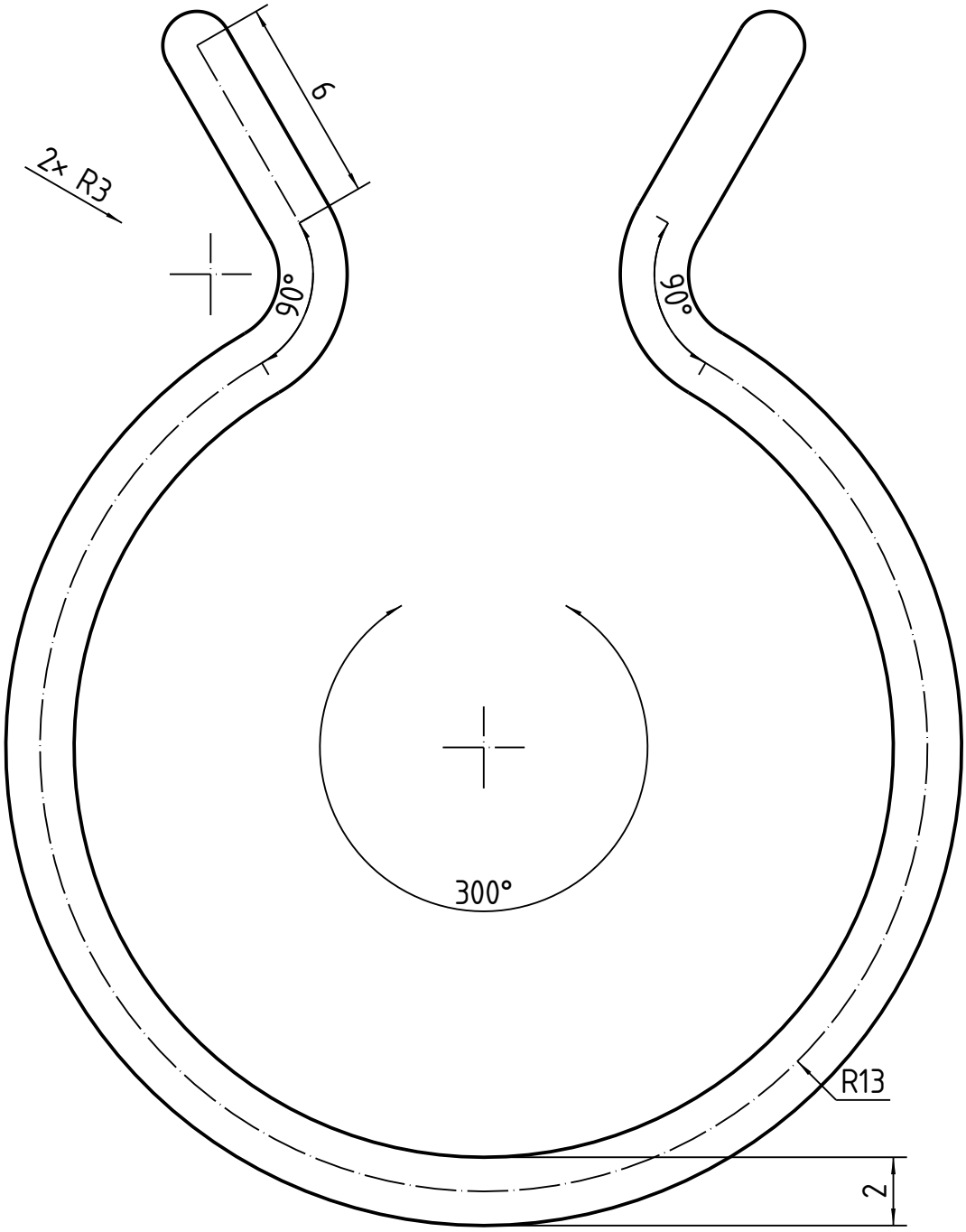
2D exercise 13

planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Scale 1:1

Print at 100 %



Spring clip

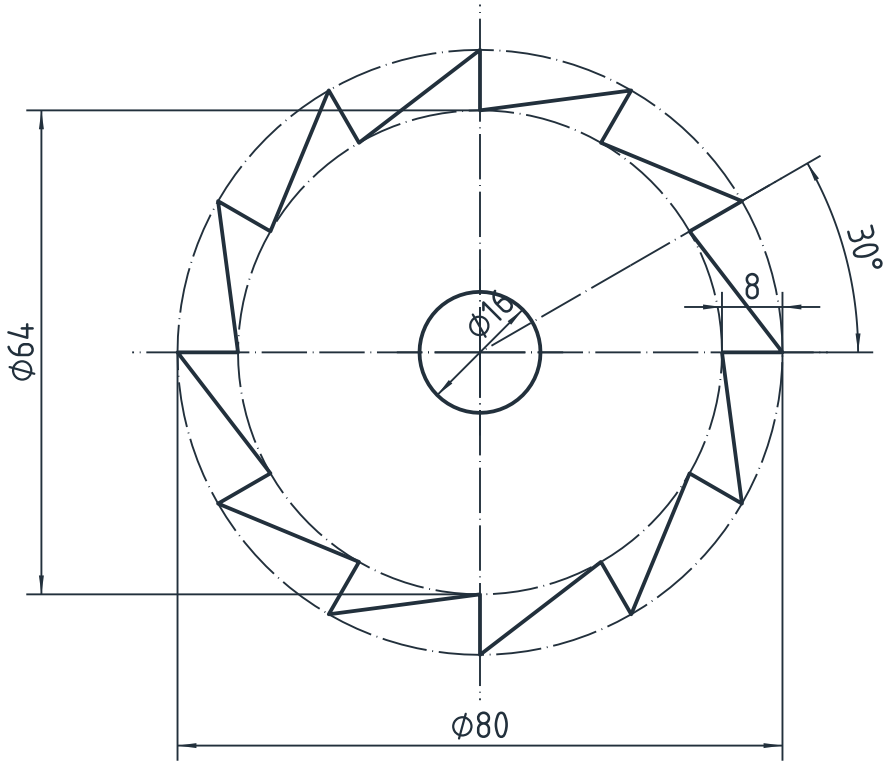
2D exercise 14

planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Scale 5:1

Print at 100 %



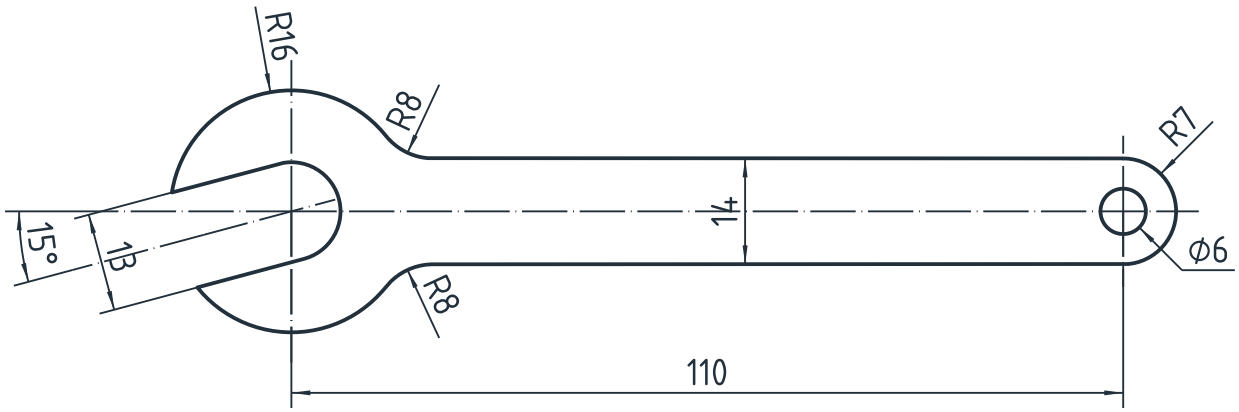
Ratchet wheel

Scale 1:1

2D exercise 15 · planex2d.org/docs/exercises/ratchet-wheel.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



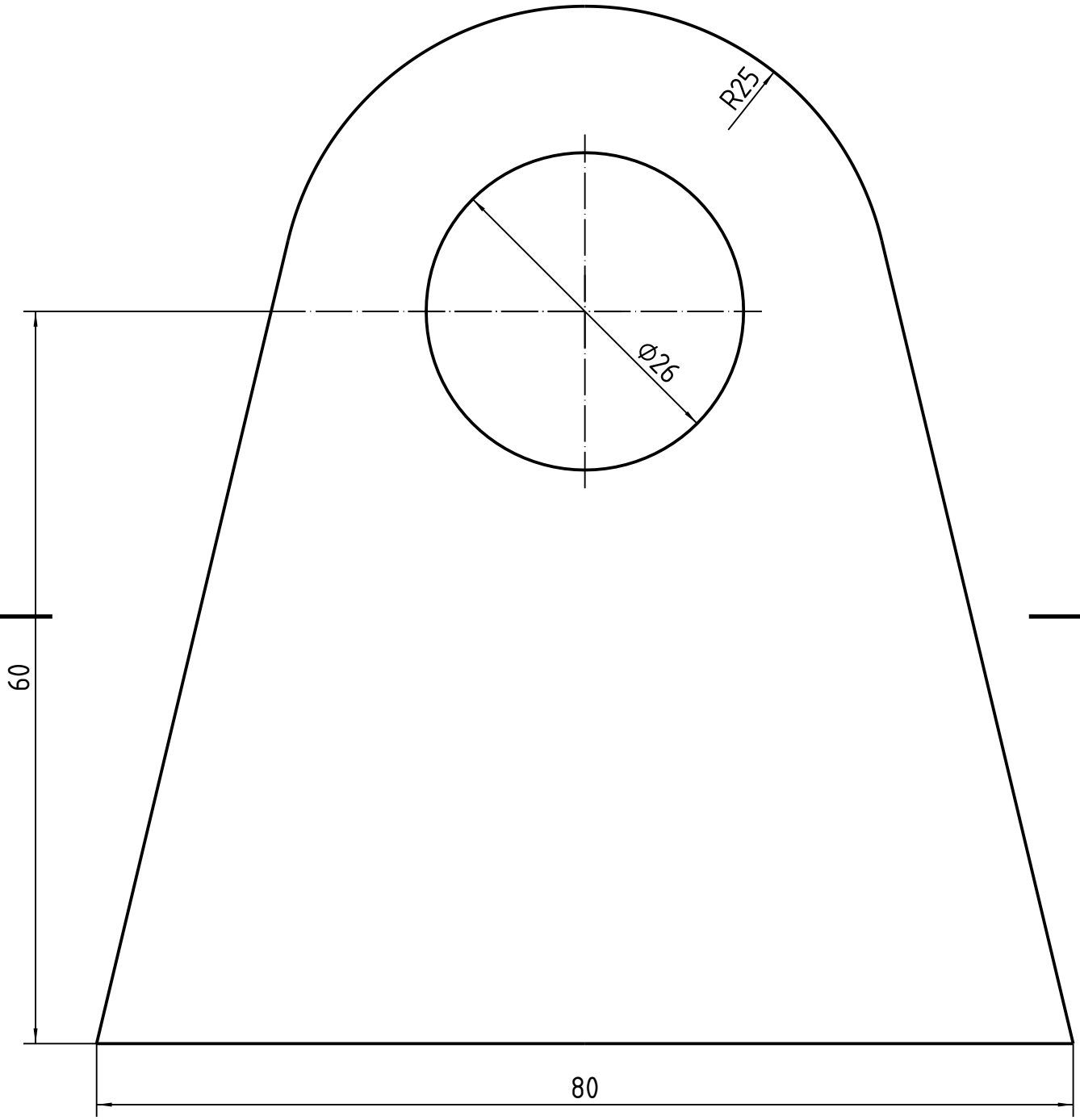
Open-end spanner

Scale 1:1

2D exercise 16 · planex2d.org/docs/exercises/open-end-spanner.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Lifting lug

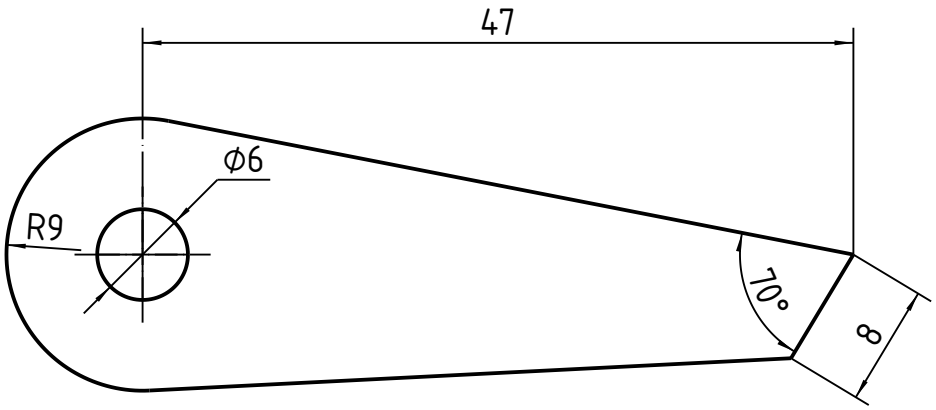
2D exercise 17

planex2d.org/docs/exercises

Scale 2:1

Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Ratchet pawl

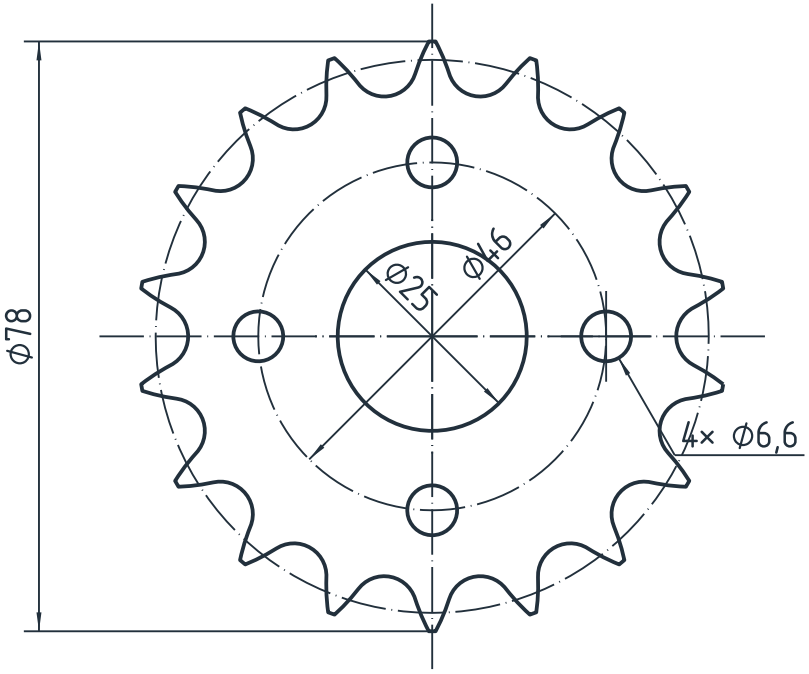
2D exercise 18

planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Scale 2:1

Print at 100 %



Number of teeth z	18
Chain pitch p	12,7
Roller diameter	8,51
Pitch diameter d	73,136
Seat radius	4,3
Seating angle	125°
Flank radius	25

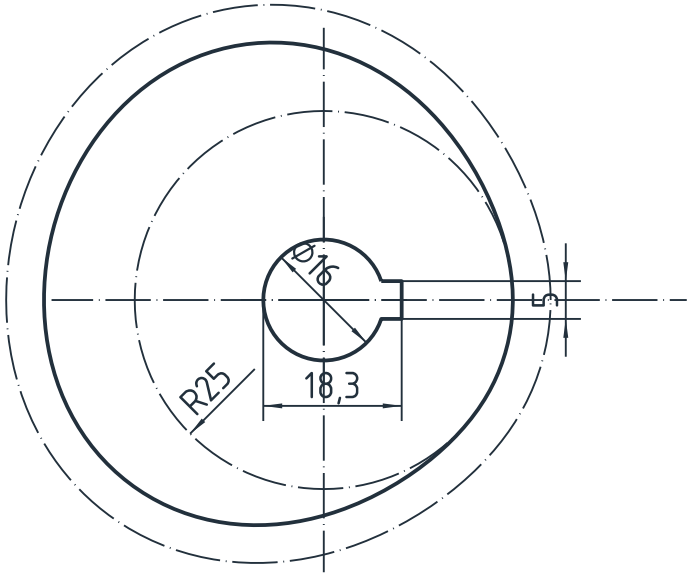
Chain sprocket

Scale 1:1

2D exercise 19 · planex2d.org/docs/exercises/chain-sprocket.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Roller diameter	10
Lift h	12
Rise 0° to 150°	cycloidal
Return 180° to 330°	cycloidal
Angle from the keyway	Lift
0°	0
30°	0,584
60°	3,677
90°	8,323
120°	11,416
150°	12
180°	12
210°	11,416
240°	8,323
270°	3,677
300°	0,584
330°	0

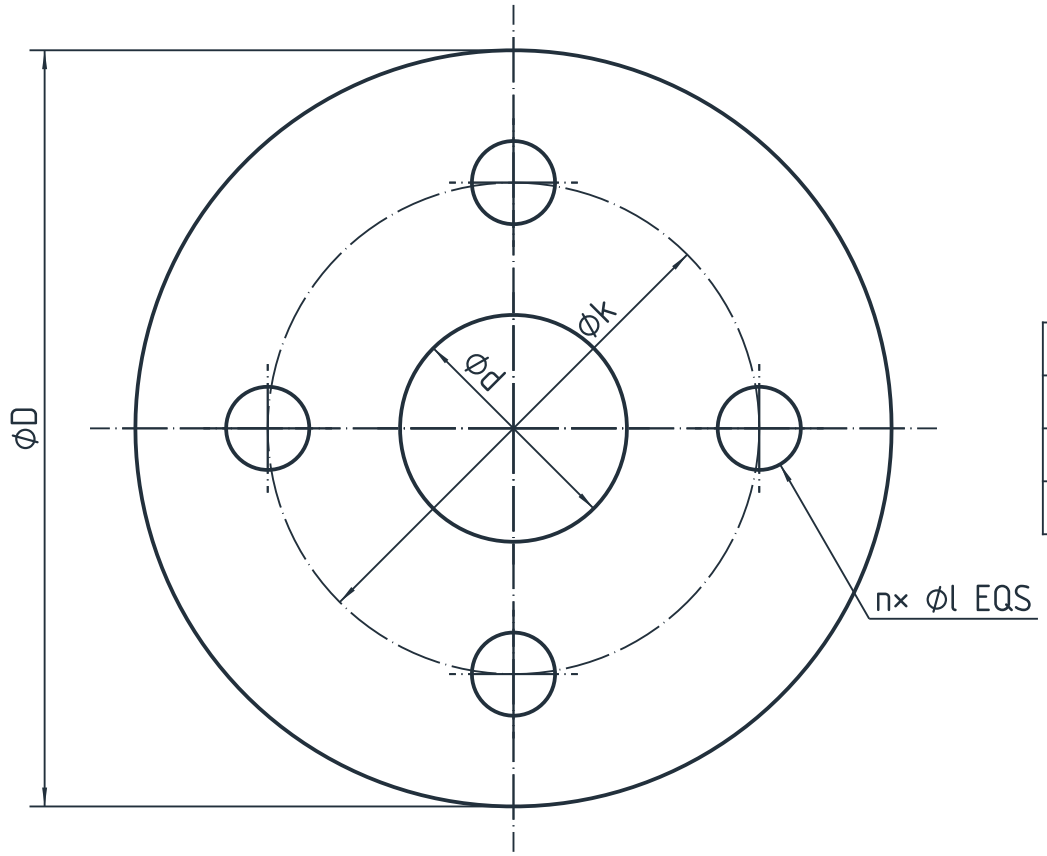
Disc cam

Scale 1:1

2D exercise 20 · planex2d.org/docs/exercises/disc-cam.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Size	D	d	k	n	l
A	100	30	65	4	11
B	125	45	85	4	13,5
C	160	60	110	8	13,5

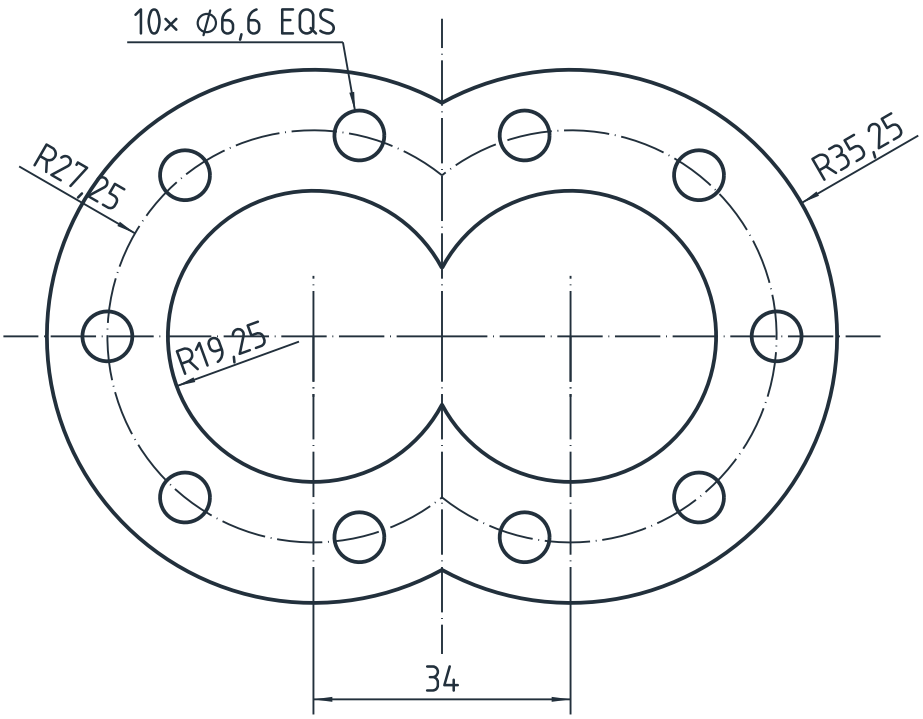
Flange series

Scale 1:1

2D exercise 21 · planex2d.org/docs/exercises/flange-series.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Gear pump gasket

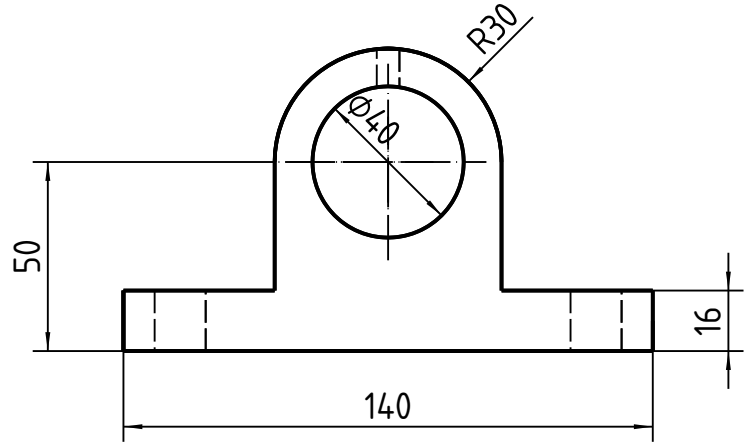
Scale 1:1

2D exercise 22 · planex2d.org/docs/exercises/pump-gasket.html

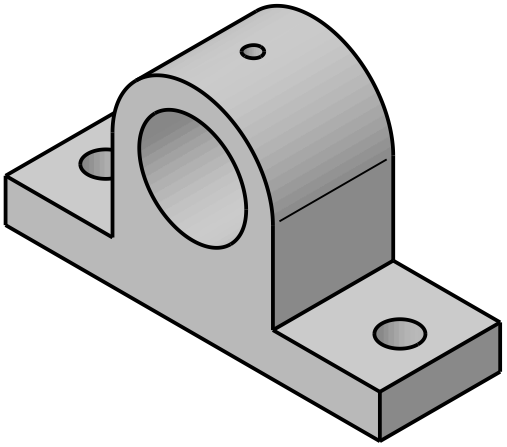
Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

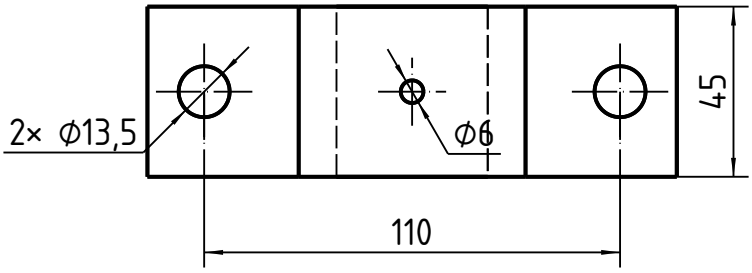
Front view



Isometric view



Top view



Pillow block

3D exercise 01

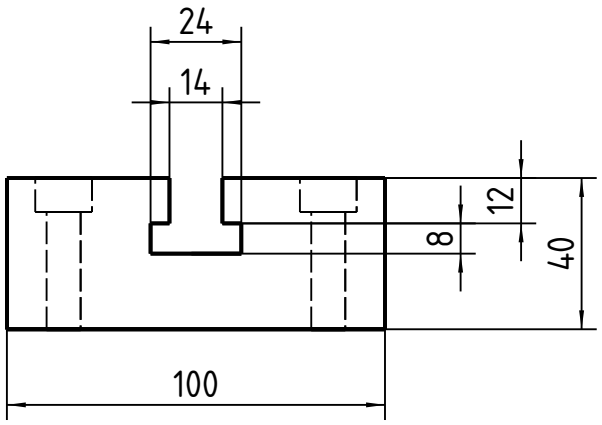
planex2d.org/docs/exercises

Scale 1:2

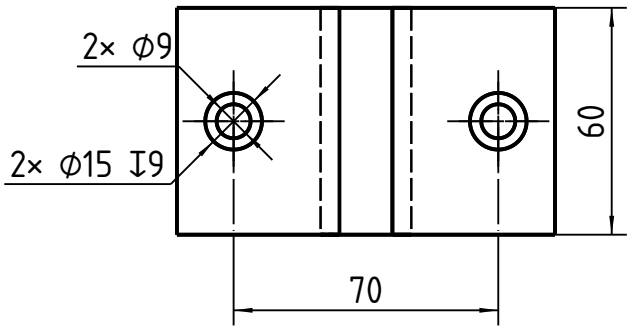
Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

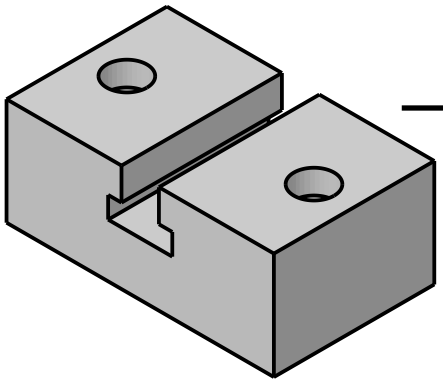
Front view



Top view



Isometric view



Guide block

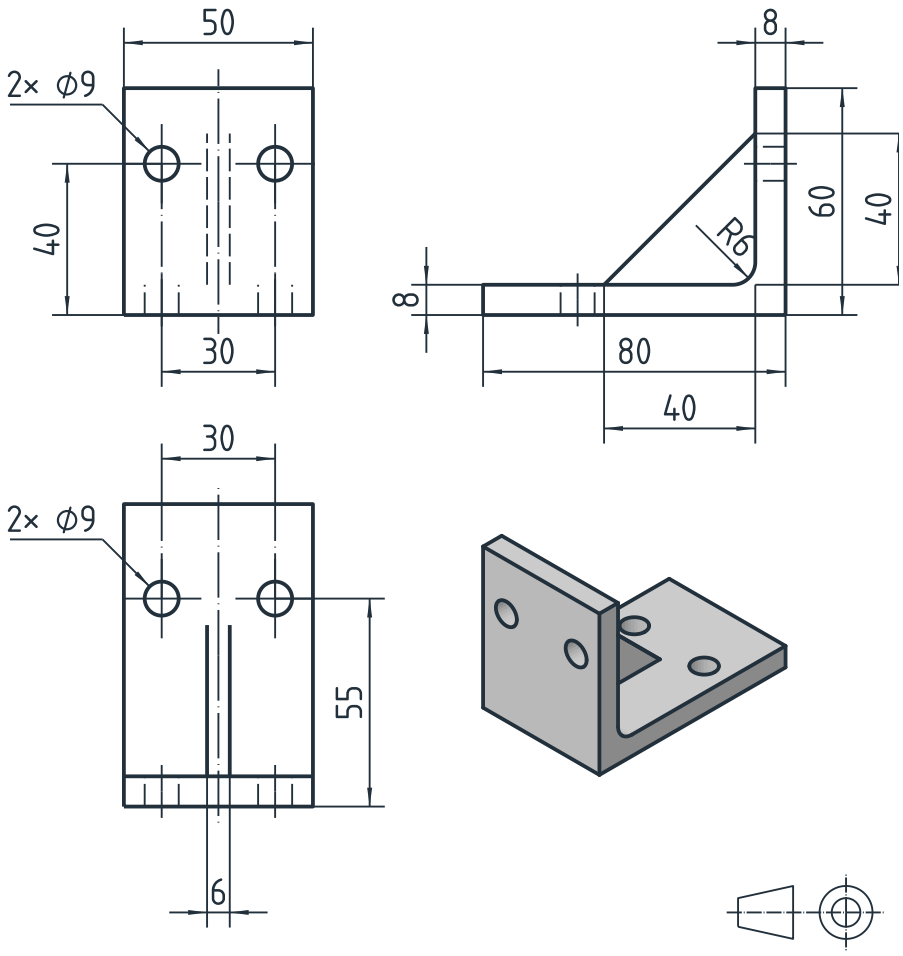
3D exercise 02

planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Scale 1:2

Print at 100 %



Angle bracket

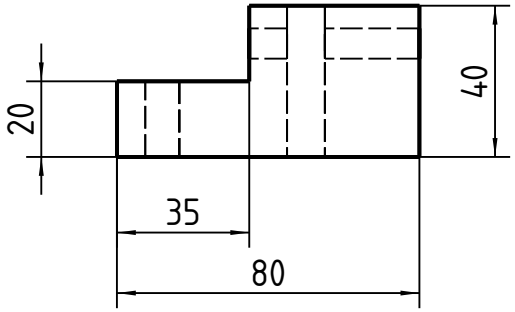
Scale 1:2

3D exercise 03 · planex2d.org/docs/exercises/angle-bracket.html

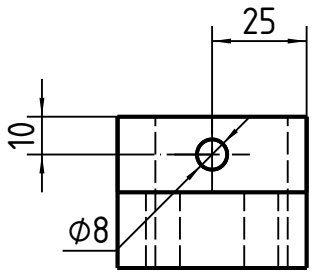
Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

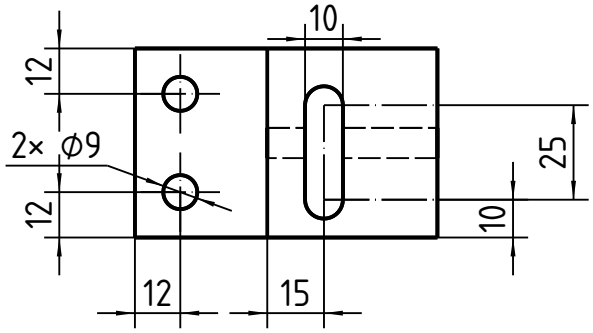
Front view



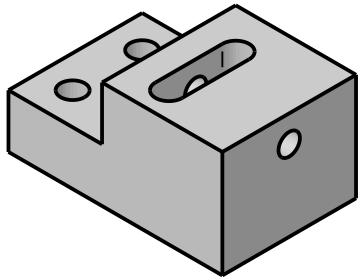
Left view



Top view



Isometric view



Step block

3D exercise 04

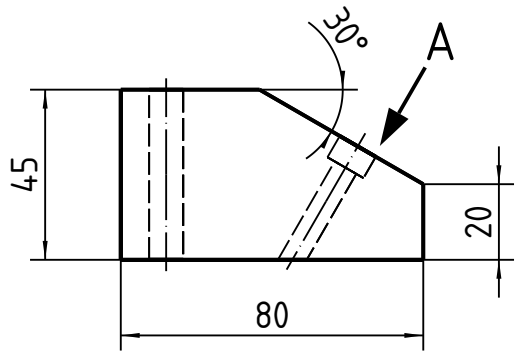
planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

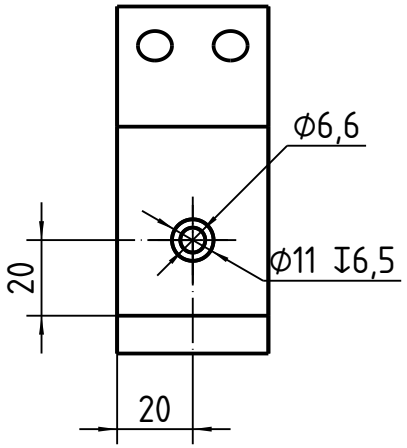
Scale 1:2

Print at 100 %

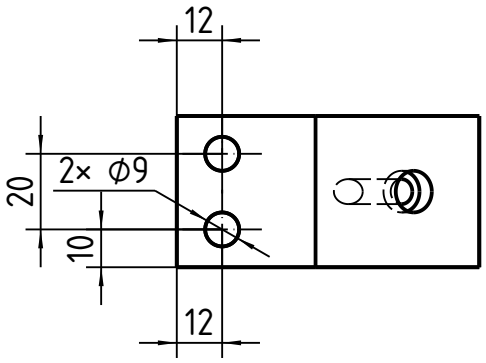
Front view



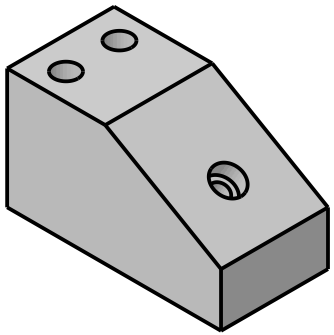
A



Top view



Isometric view



Inclined block

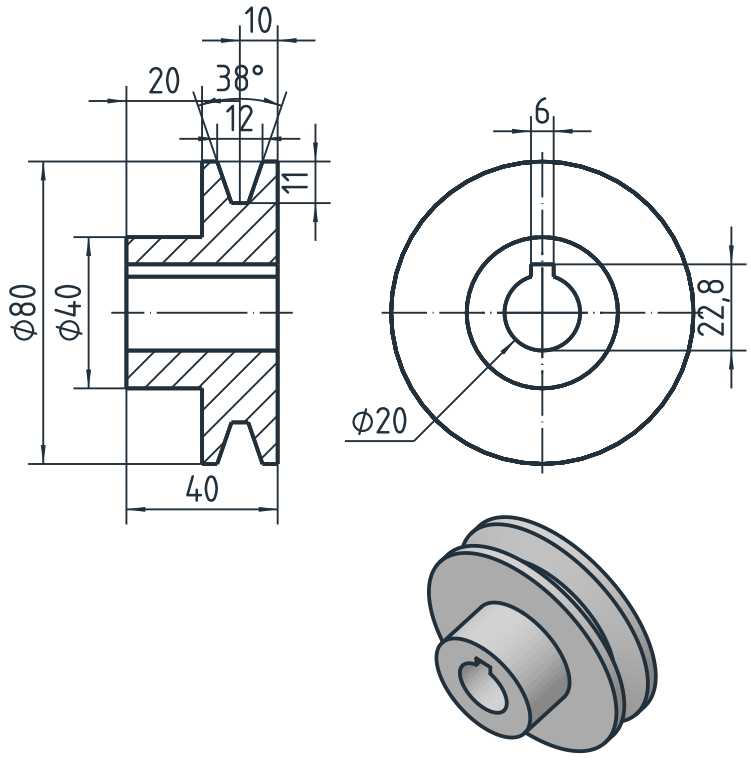
3D exercise 05

planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Scale 1:2

Print at 100 %



V-belt pulley

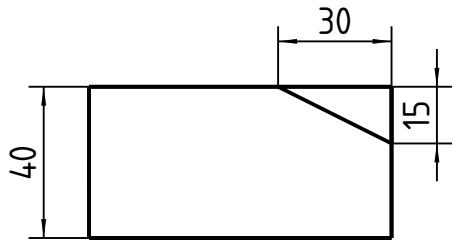
Scale 1:2

3D exercise 06 · planex2d.org/docs/exercises/v-belt-pulley.html

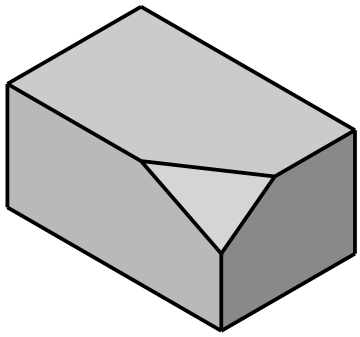
Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

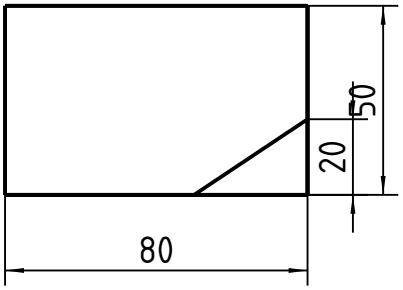
Front view



Isometric view



Top view



Corner block

3D exercise 07

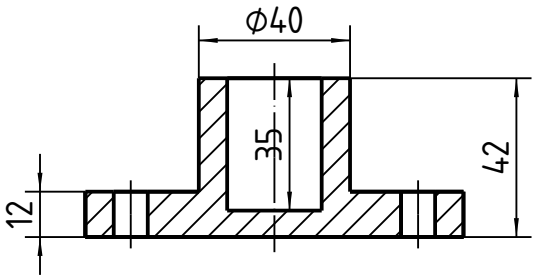
planex2d.org/docs/exercises

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

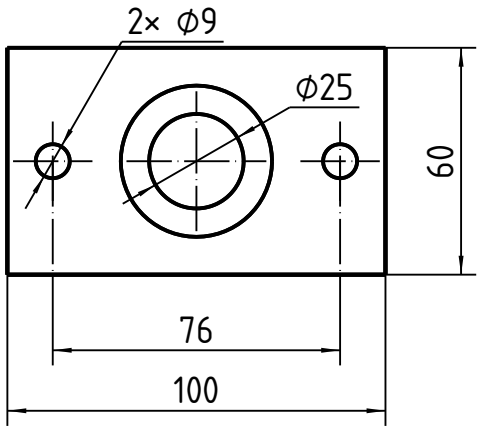
Scale 1:2

Print at 100 %

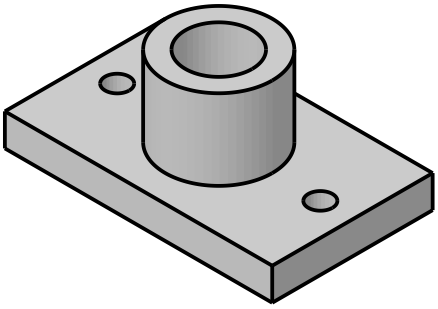
Section view



Top view



Isometric view



Column base

3D exercise 08

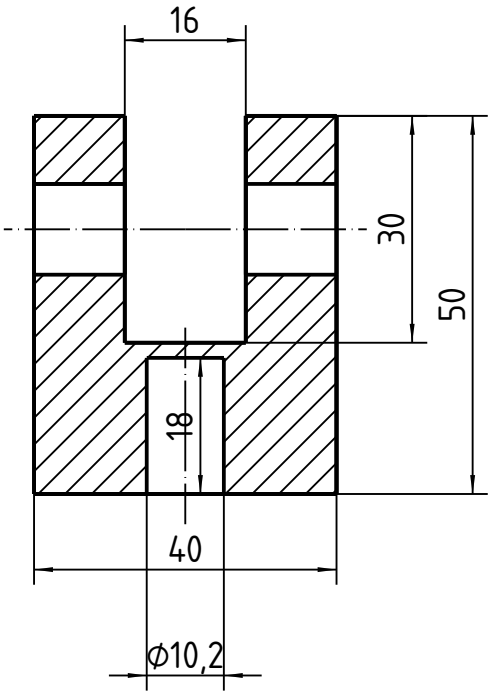
planex2d.org/docs/exercises

Scale 1:2

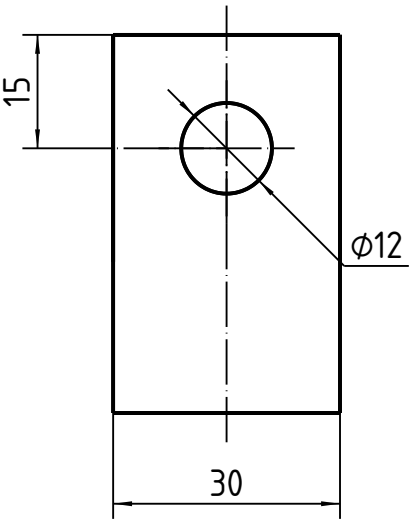
Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

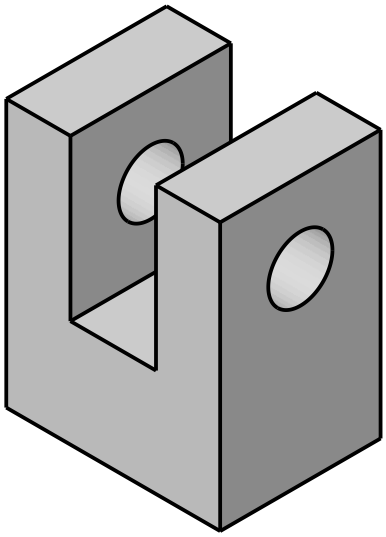
Section view



Left view



Isometric view



Clevis

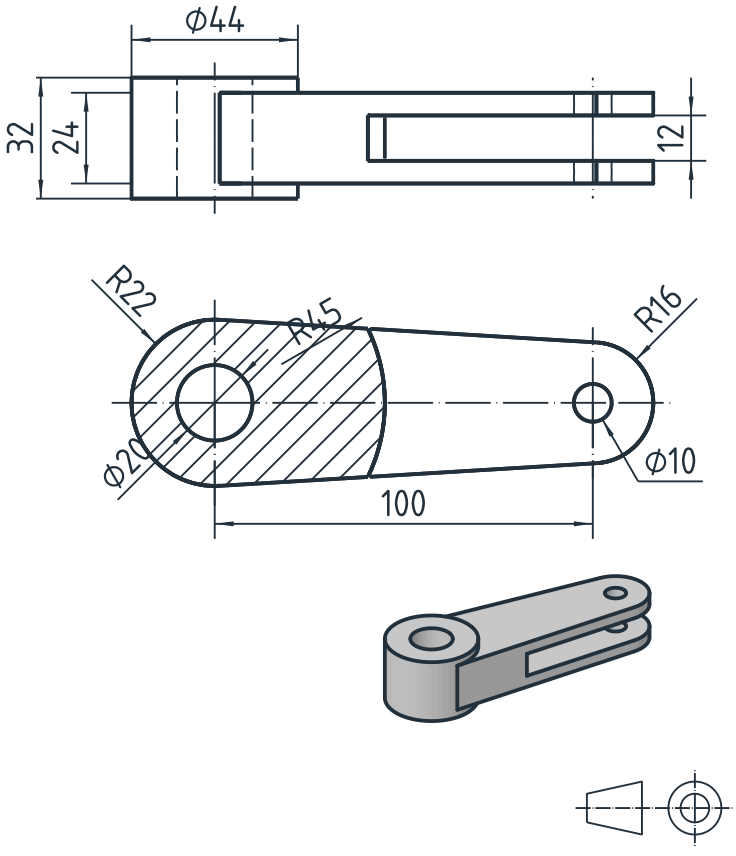
3D exercise 09

planex2d.org/docs/exercises

Scale 1:1

Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



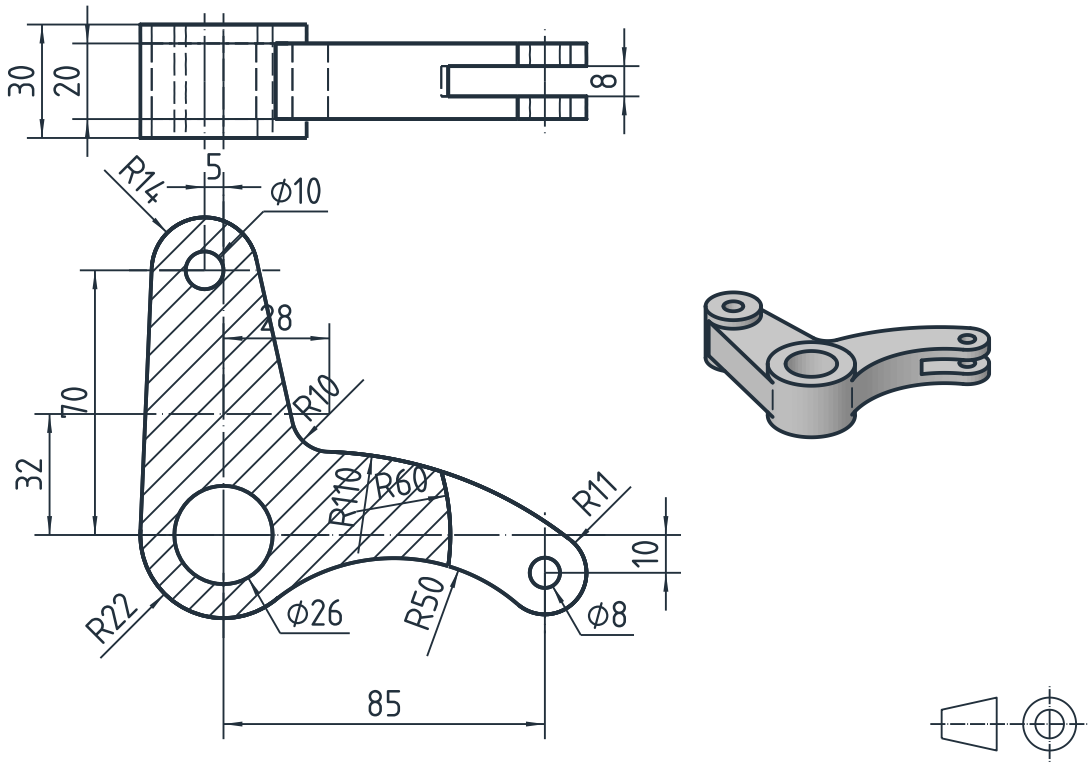
Fork lever

Scale 1:2

3D exercise 10 · planex2d.org/docs/exercises/fork-lever.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Rocker

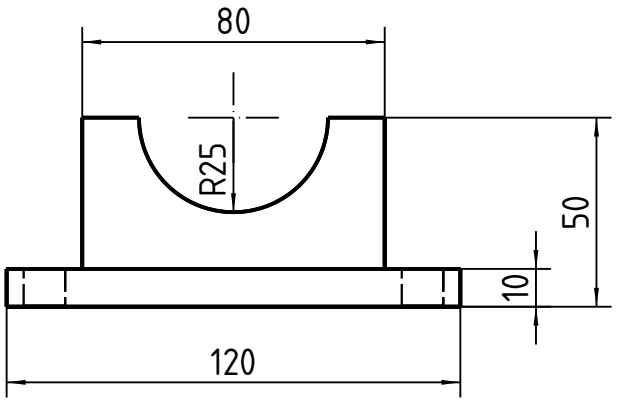
Scale 1:2

3D exercise 11 · planex2d.org/docs/exercises/rocker.html

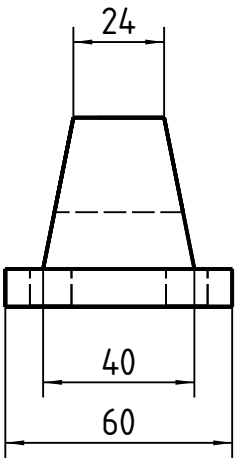
Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

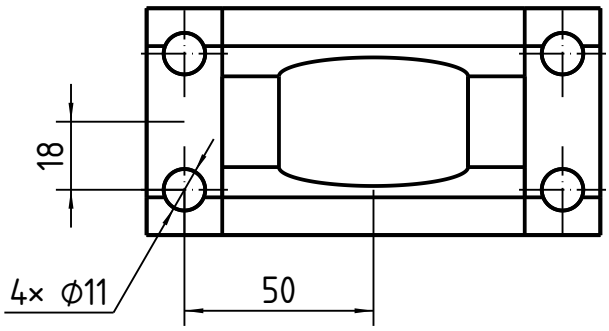
Front view



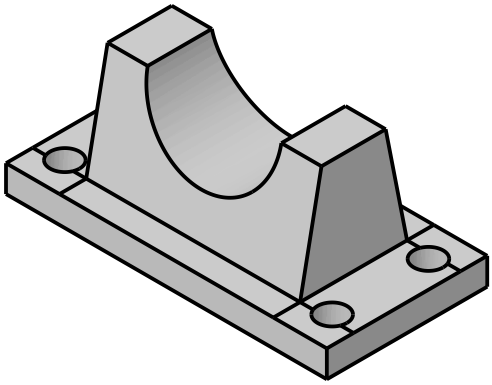
Left view



Top view



Isometric view



Saddle support

3D exercise 12

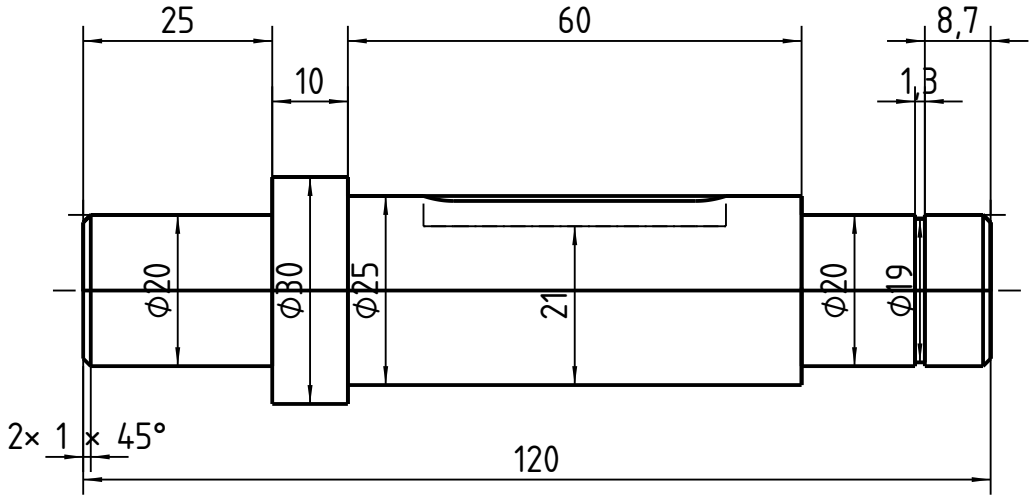
planex2d.org/docs/exercises

Scale 1:2

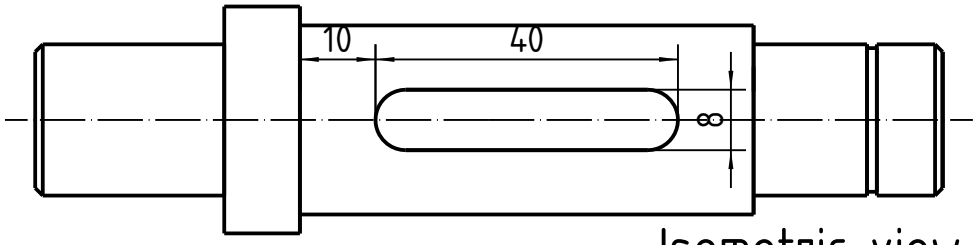
Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

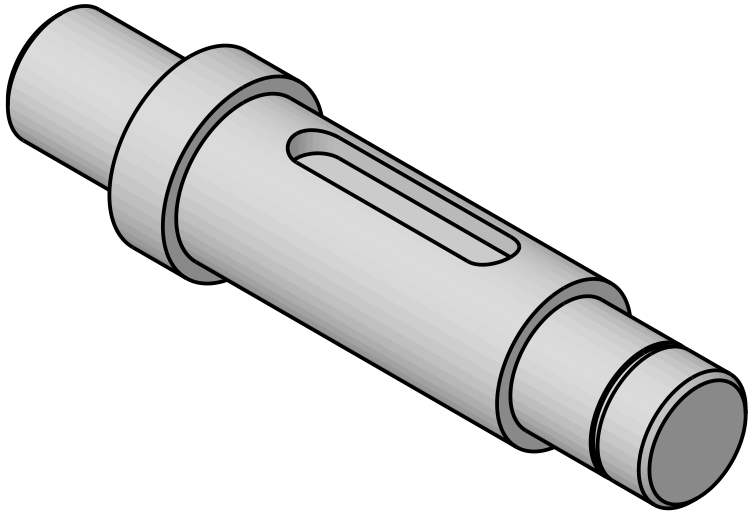
Front view



Top view



Isometric view



Stepped shaft

3D exercise 13

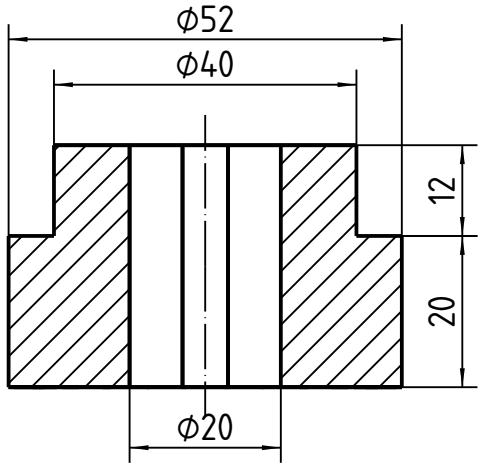
planex2d.org/docs/exercises

Scale 1:1

Print at 100 %

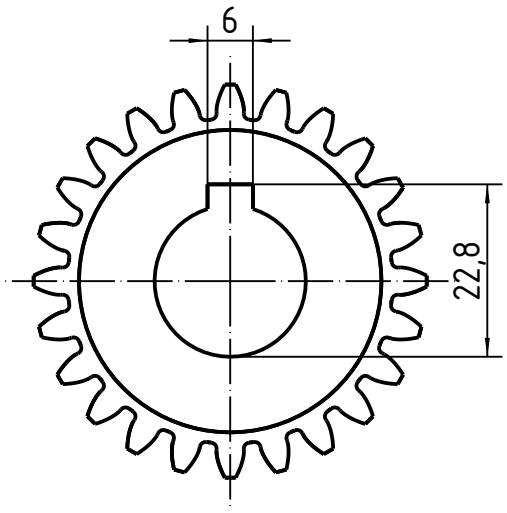
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Section view

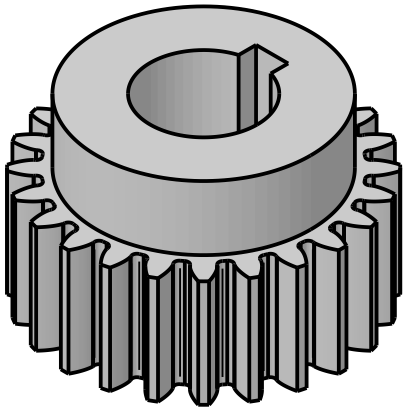


Module m	2
Number of teeth z	24
Pressure angle α	20°
Profile shift x	0
Pitch diameter d	48
Root fillet radius	0,8
Span over 3 teeth W	15,433

Top view



Isometric view



Spur gear

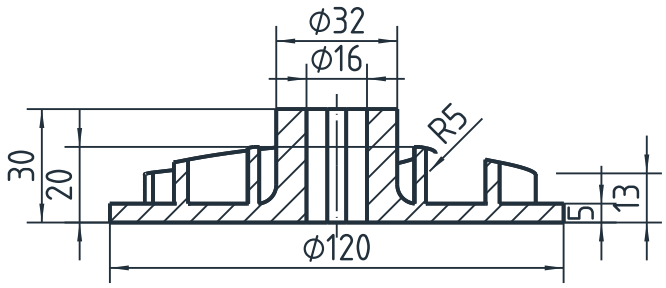
3D exercise 14

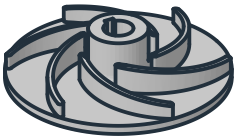
planex2d.org/docs/exercises

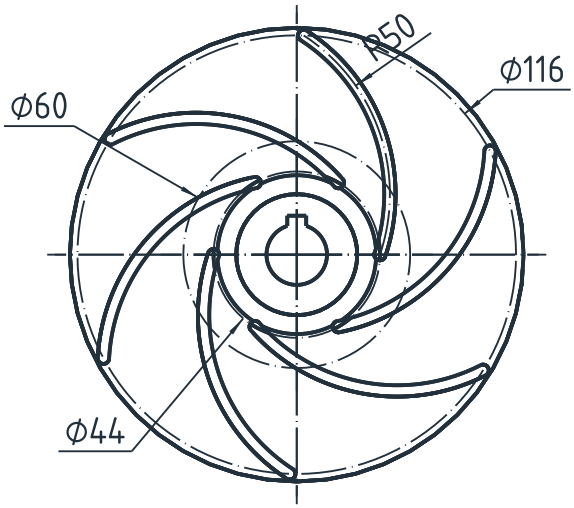
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

Scale 1:1

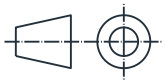
Print at 100 %







Blades	6
Blade thickness	3



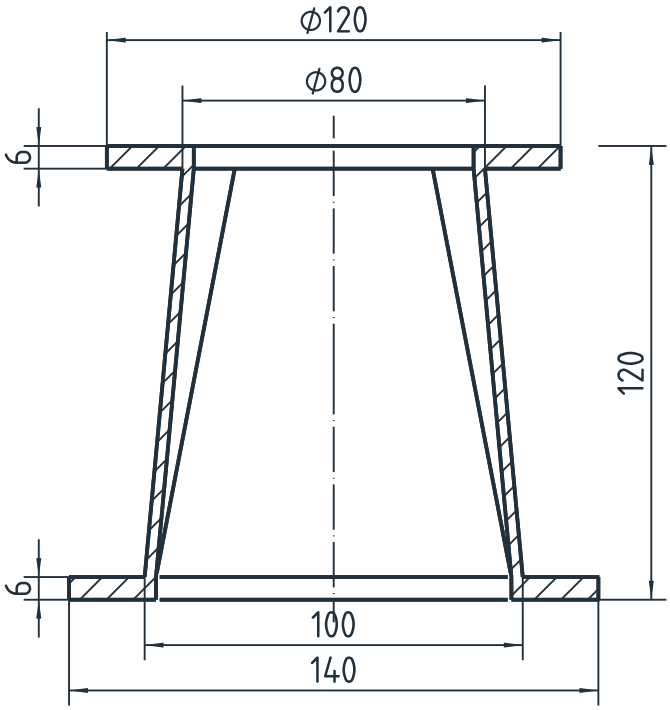
Impeller

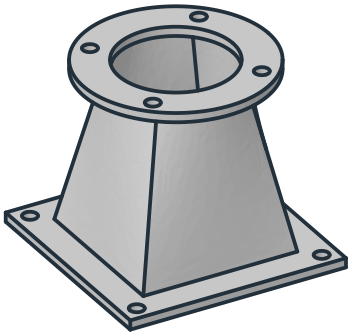
Scale 1:2

3D exercise 15 · planex2d.org/docs/exercises/impeller.html

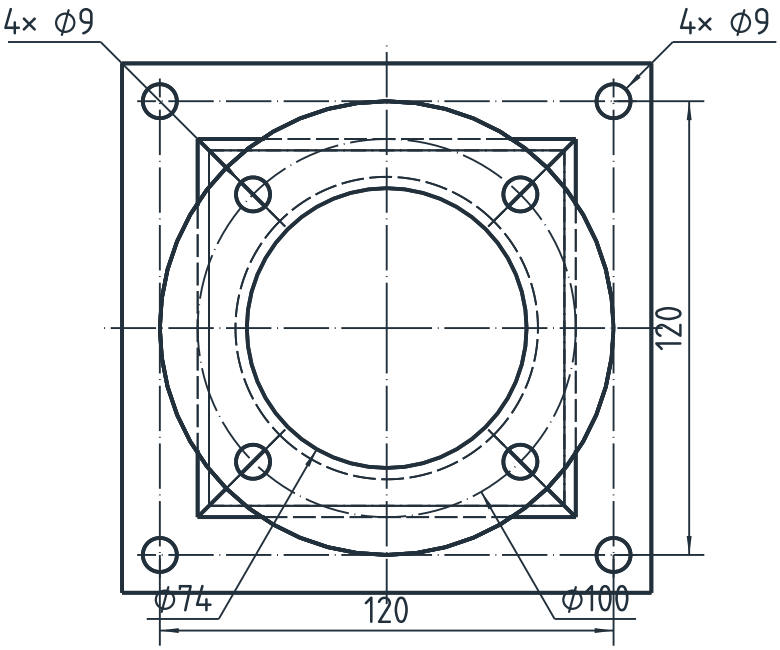
Print at actual size (100 %)

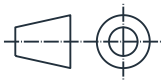
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html





Wall	3 all around





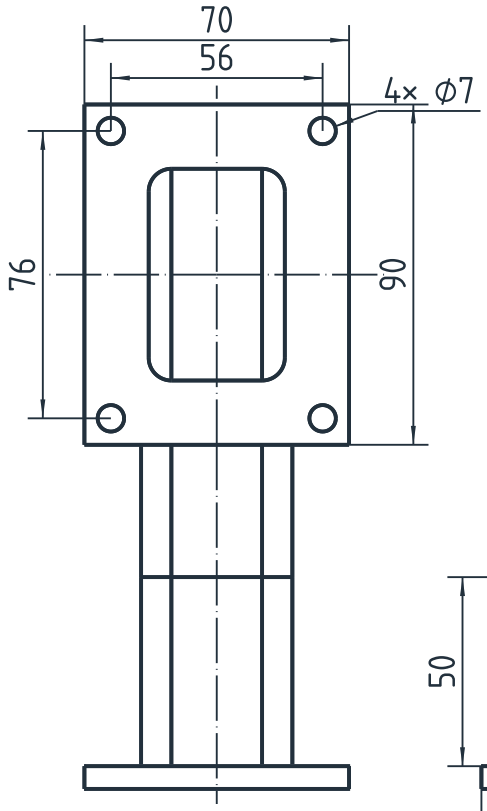
Square-to-round transition

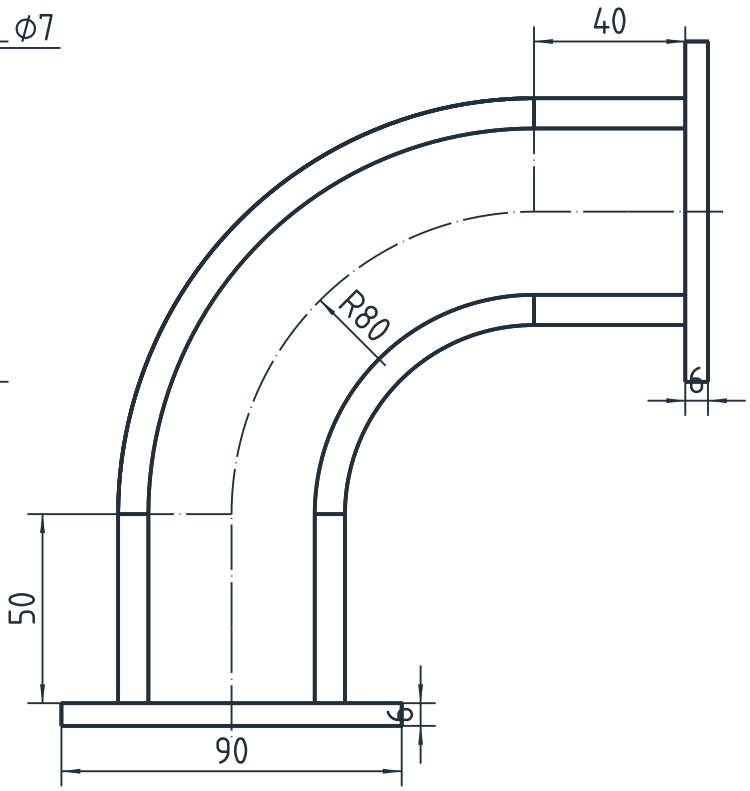
Scale 1:2

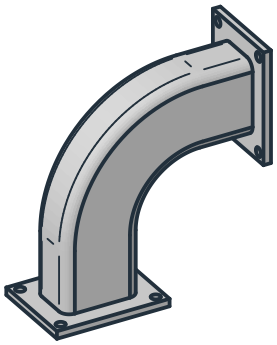
3D exercise 16 · planex2d.org/docs/exercises/square-to-round.html

Print at actual size (100 %)

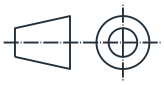
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html







Duct outside	60 × 40
Corner radius outside	8
Wall	2



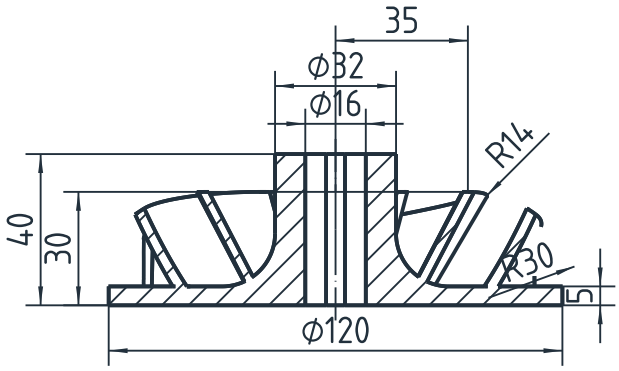
Elbow duct

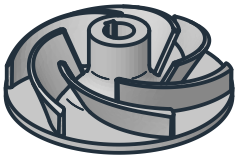
Scale 1:2

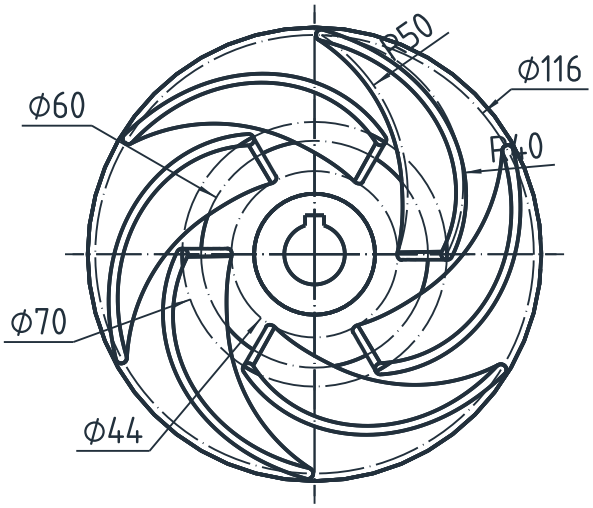
3D exercise 17 · planex2d.org/docs/exercises/elbow-duct.html

Print at actual size (100 %)

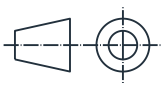
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html







Blades	6
Blade thickness	3
Hub section at	z = 5
Top section at	z = 30



Impeller with twisted blades

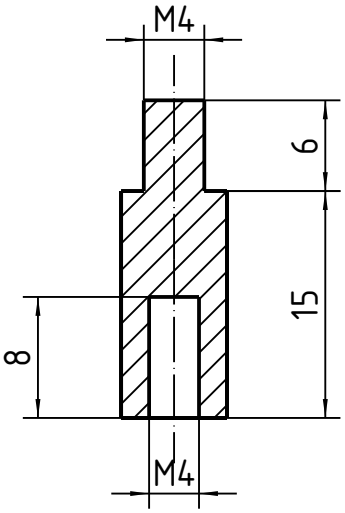
Scale 1:2

3D exercise 18 · planex2d.org/docs/exercises/twisted-impeller.html

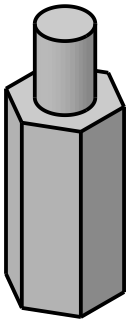
Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

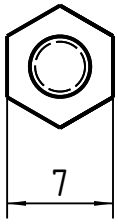
Section view



Isometric view



Top view



Hex standoff

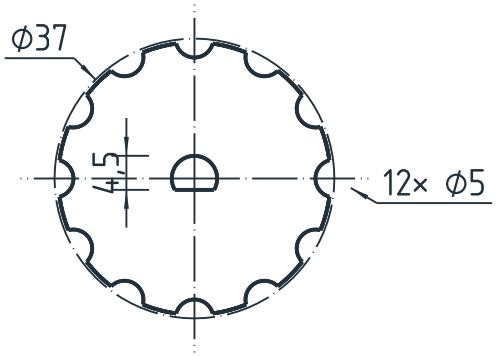
3D exercise 19

planex2d.org/docs/exercises

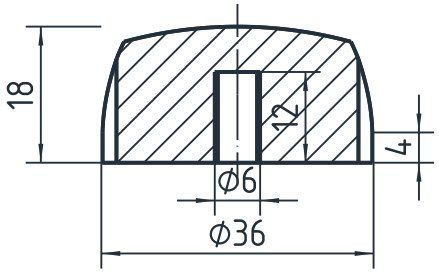
Scale 2:1

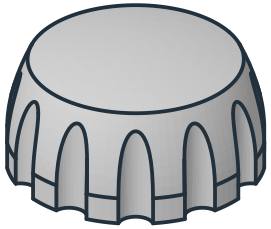
Print at 100 %

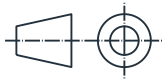
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Point	r	z
P1	17,6	8
P2	16,6	12
P3	15	16
Dome	R57,25	







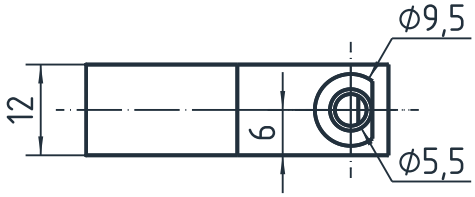
Control knob

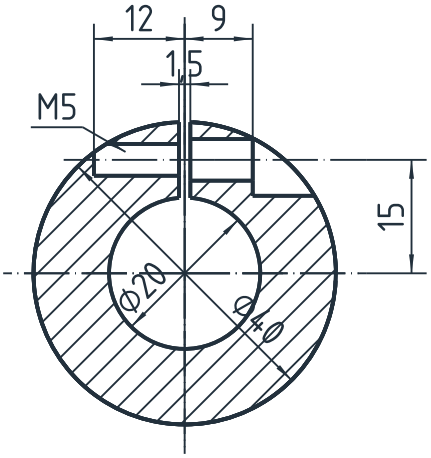
Scale 1:1

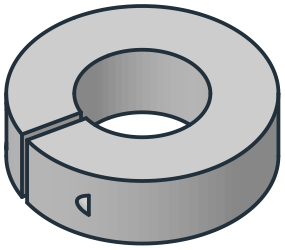
3D exercise 20 · planex2d.org/docs/exercises/control-knob.html

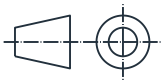
Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html









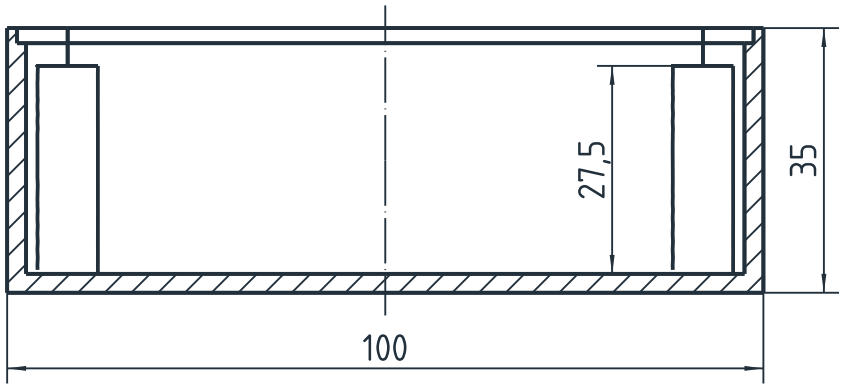
Split shaft collar

Scale 1:1

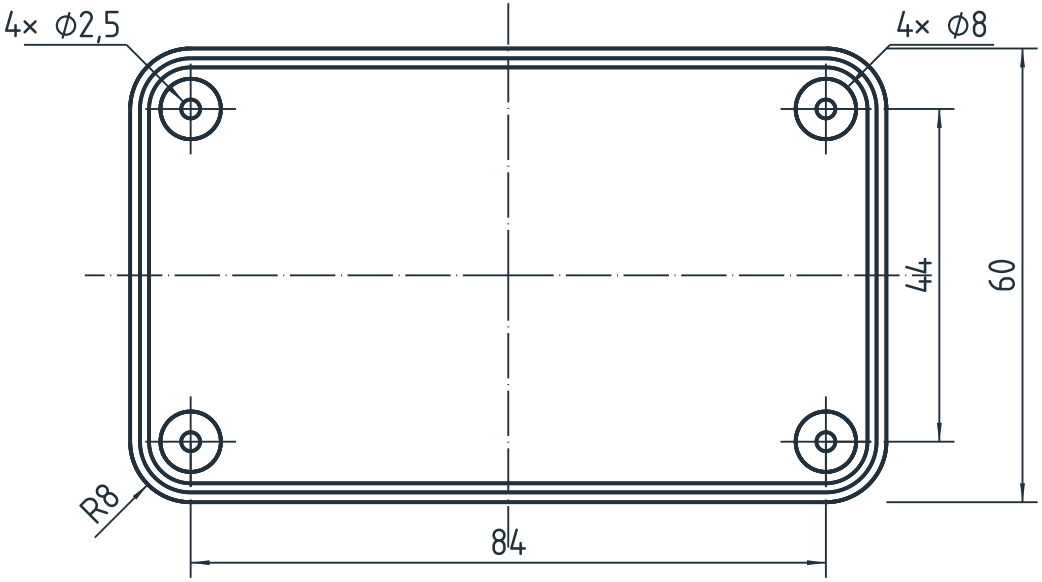
3D exercise 21 · planex2d.org/docs/exercises/shaft-collar.html

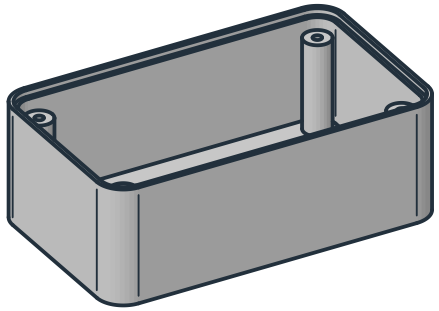
Print at actual size (100 %)

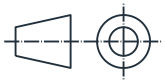
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Wall and floor	2,5
Rebate for the lid	1,2 wide, 2 deep







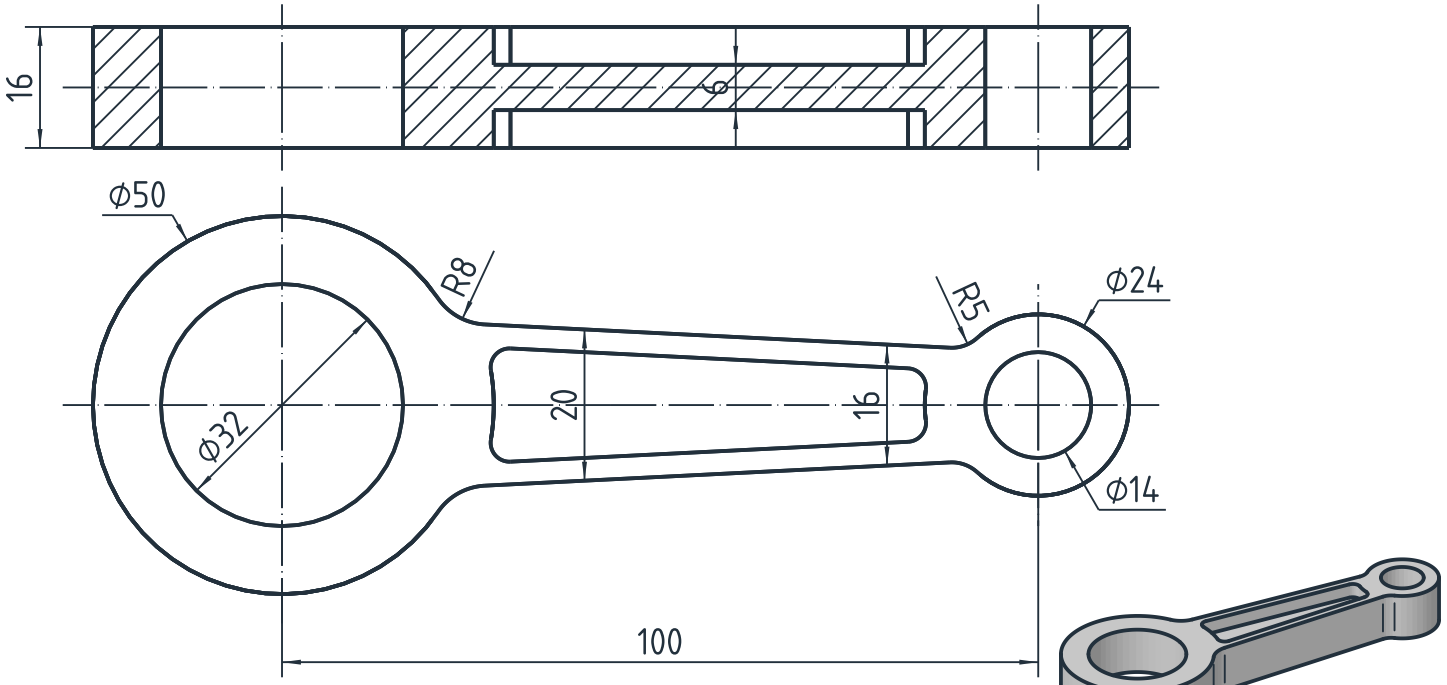
Electronics enclosure

Scale 1:1

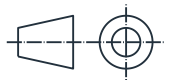
3D exercise 22 · planex2d.org/docs/exercises/enclosure.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



Flanges	3 wide
Web	6
Pocket's ends	R28, R15
Pocket's corners	R2,5



Connecting rod

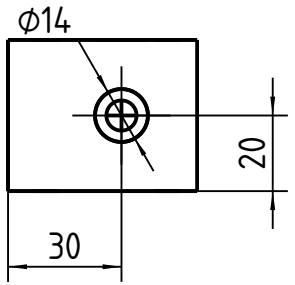
Scale 1:1

3D exercise 23 · planex2d.org/docs/exercises/connecting-rod.html

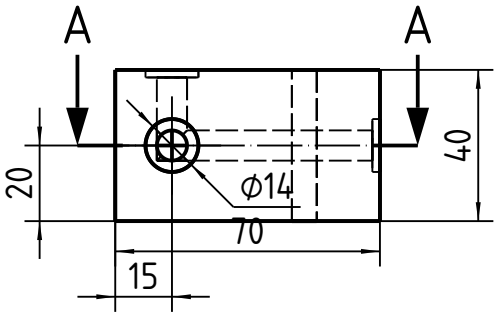
Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

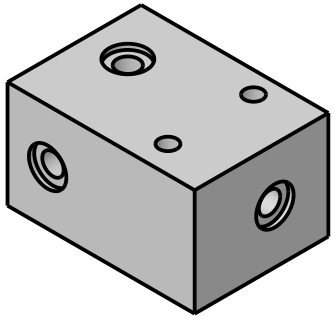
Right view



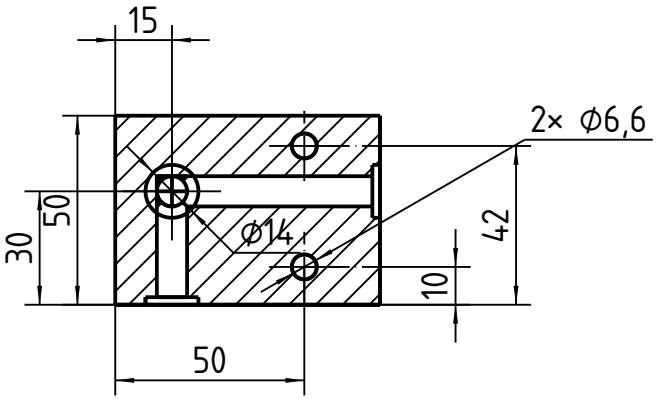
Front view



Isometric view

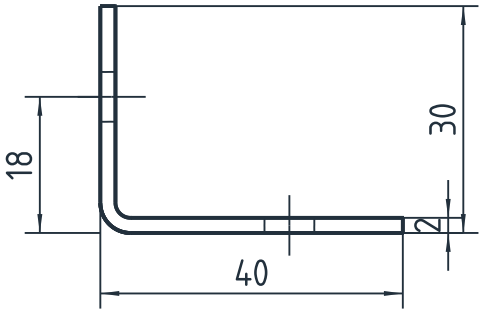


A–A

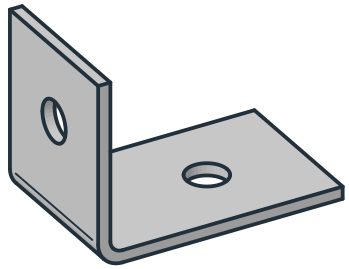


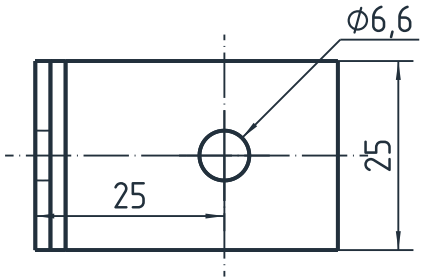
Manifold block 3D exercise 24	planex2d.org/docs/exercises	Scale 1:2 Print at 100 %

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

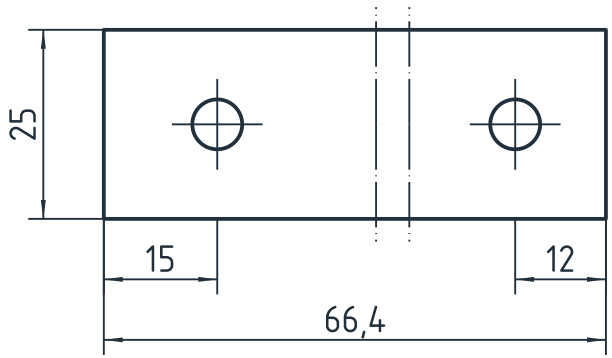


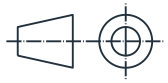
Thickness t	2
Inside radius R	2
K-factor	0,4
Bend allowance	4,398





Flat pattern





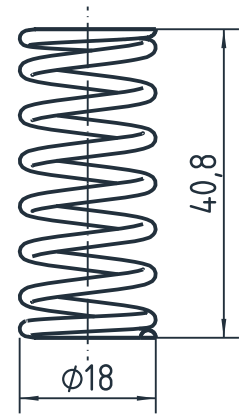
Sheet-metal bracket

Scale 1:1

3D exercise 25 · planex2d.org/docs/exercises/sheet-metal-bracket.html

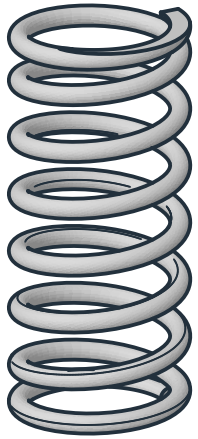
Print at actual size (100 %)

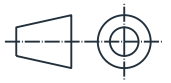
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html





Wire diameter d	2
Mean diameter D	16
Total coils	8
Active coils	6
Pitch of the active coils	6
Free length	40,8
Coiling	right-hand
Ends	closed, ground





Compression spring

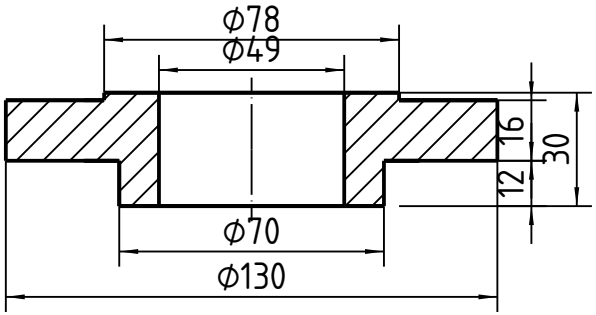
Scale 1:1

3D exercise 26 · planex2d.org/docs/exercises/compression-spring.html

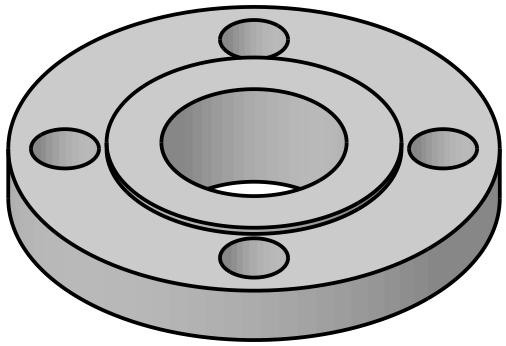
Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

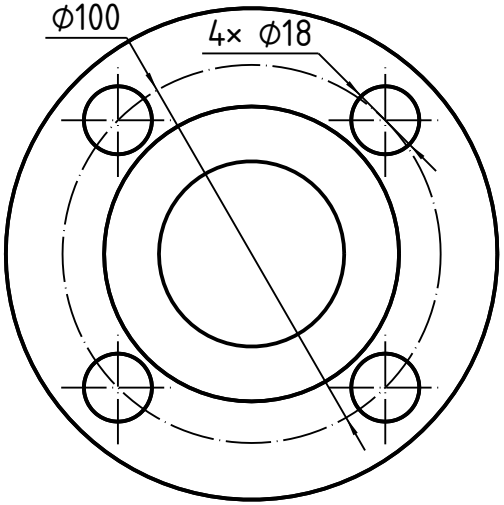
Section view



Isometric view



Top view



Pipe flange

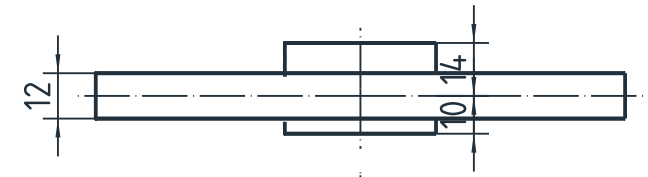
3D exercise 27

planex2d.org/docs/exercises

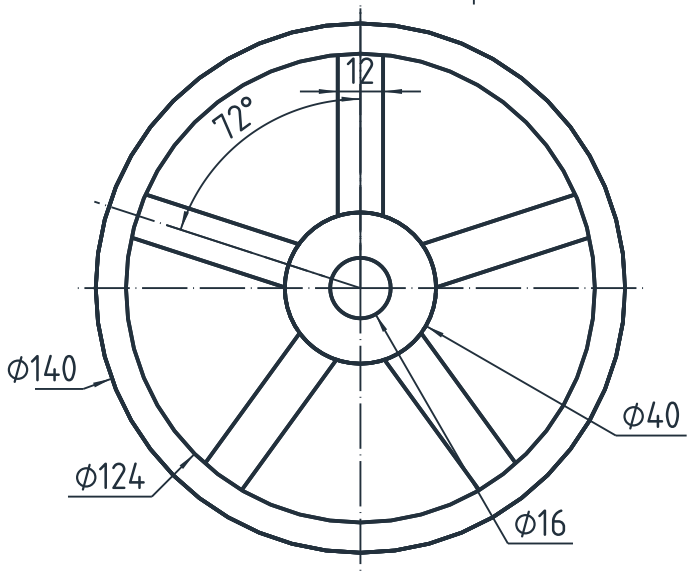
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

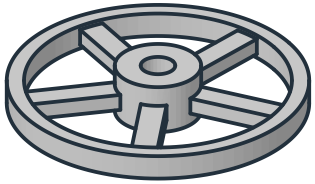
Scale 1:2

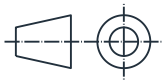
Print at 100 %



Spokes	5, 12 × 8







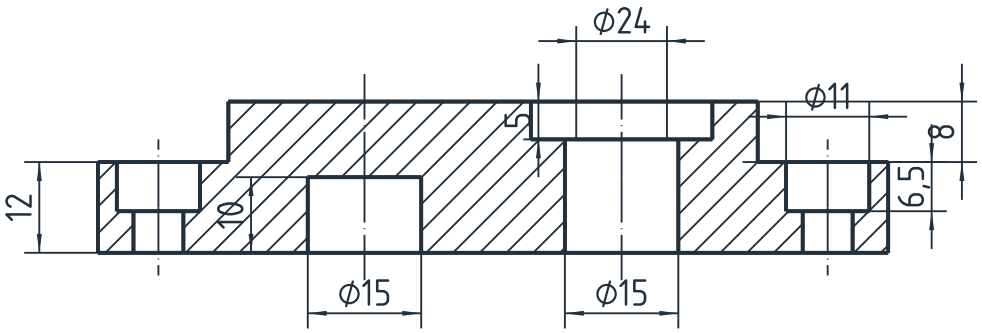
Handwheel

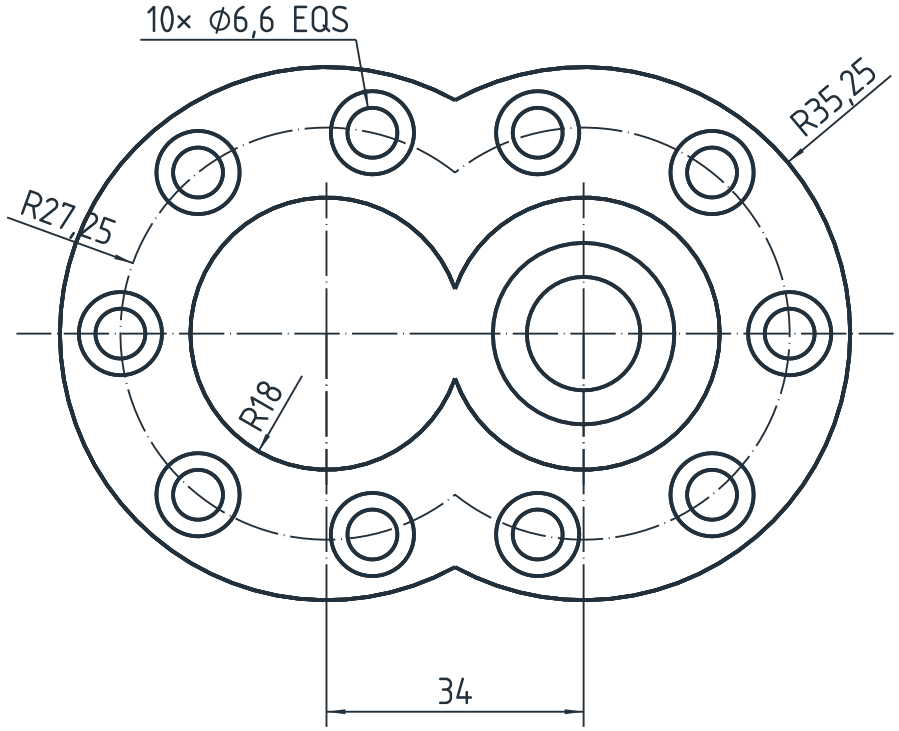
Scale 1:2

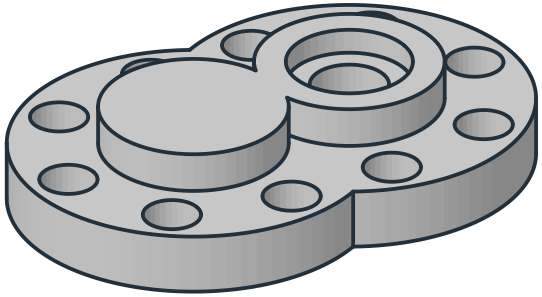
3D exercise 28 · planex2d.org/docs/exercises/handwheel.html

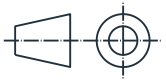
Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html









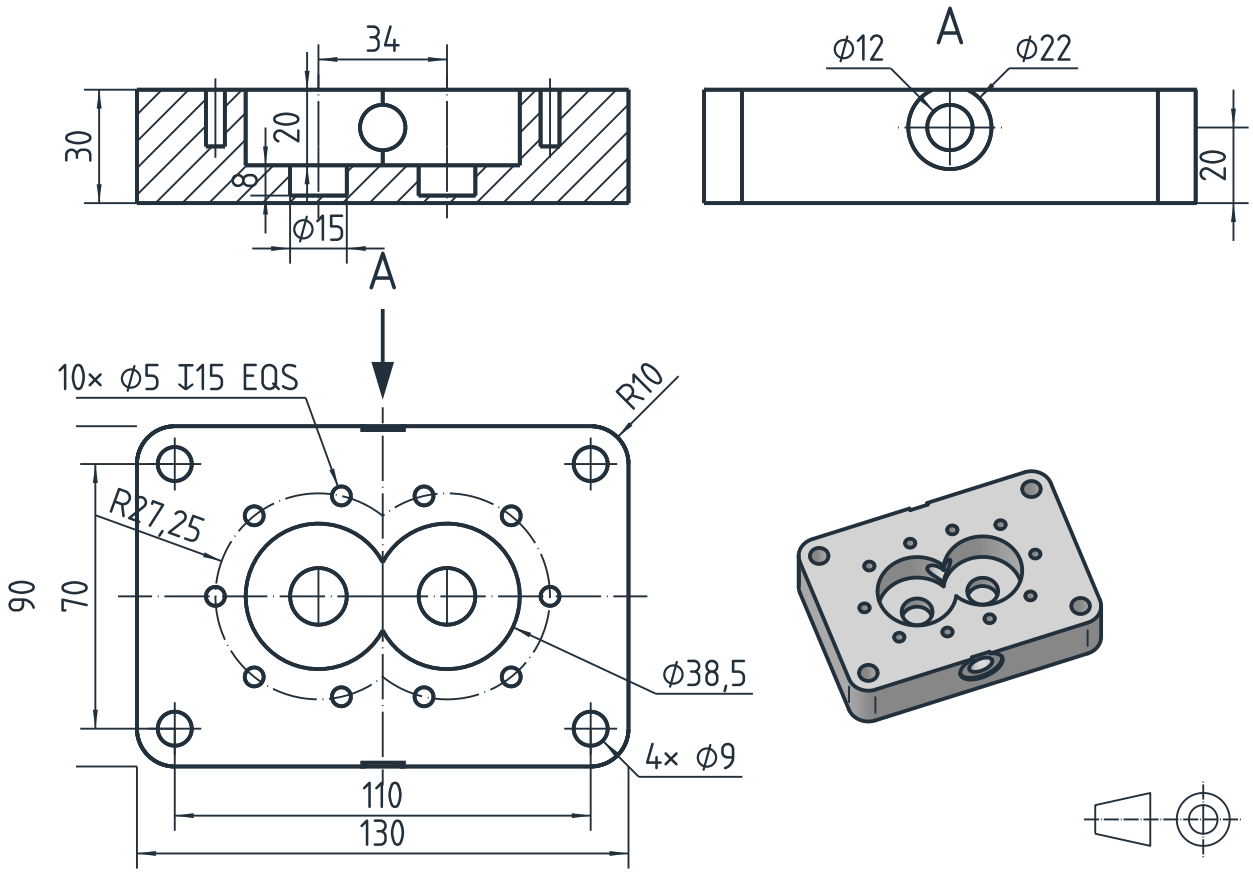
Gear pump cover

Scale 1:1

3D exercise 29 · planex2d.org/docs/exercises/pump-cover.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html



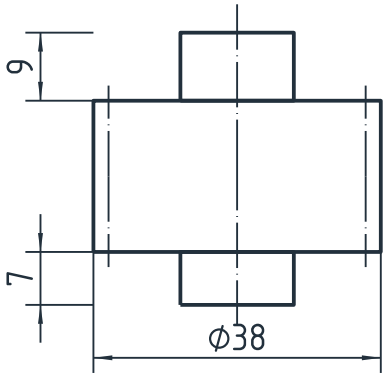
Gear pump housing

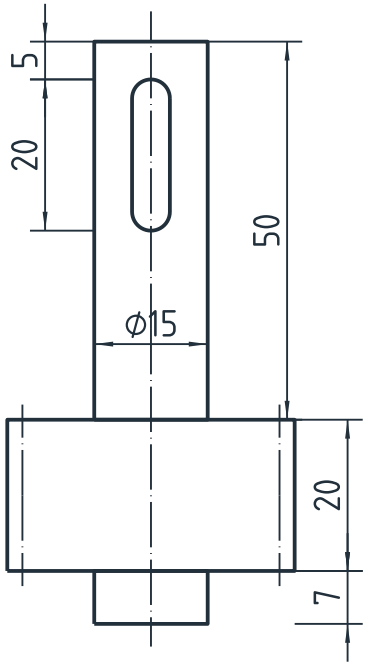
3D exercise 30 · planex2d.org/docs/exercises/pump-housing.html

Scale 1:2

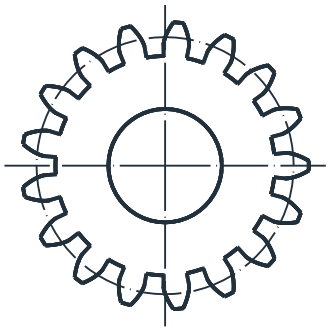
Print at actual size (100 %)

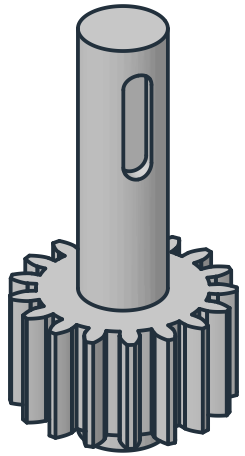
© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html

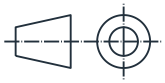




Module m	2
Number of teeth z	17
Pressure angle α	20°
Profile shift x	0
Pitch diameter d	34
Flanks thinned by	0,025
Span over 3 teeth W	15,19
Keyseat	5 wide, 3 deep







Gear pump rotors

Scale 1:1

3D exercise 31 · planex2d.org/docs/exercises/pump-rotors.html

Print at actual size (100 %)

© 2026 Sebastian Hirnschall · CC BY-NC-SA 4.0, with a permission for teaching · planex2d.org/docs/core/notices.html