venndiagram v1.1: Drawing Simple Venn Diagrams

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The venndiagram package is provided to assist generating simple two- and three-set Venn diagrams for lectures or assignment sheets. This package requires the tikz package. As from v1.1, this package no longer requires the intersections library.

> The aim of this package is to provide very simple Venn diagrams for assignments or exam questions. If you require more complex diagrams or different layouts it's simpler to directly use the tikz package.

Contents

1 Available Commands and Environments

This package defines two environments:

venndiagram3sets

```
\begin{venndiagram3sets}[⟨options⟩]
```

(for two sets) and

venndiagram2sets

> `\begin{venndiagram2sets}[⟨options⟩]`

(for three sets).

The optional argument ⟨*options*⟩ is a comma-separated list of ⟨*key*⟩=⟨*value*⟩ settings.

> If the ⟨*value*⟩ contains commas or equal signs, make sure you enclose the entire value in braces. For example:
>
> `\begin{venndiagram3sets}[tikzoptions={scale=2,thick}]`

The following keys are available:

shade The name of the colour used to shade regions (default: `lightgray`).

labelA The label for the first set (default: `$A$`).

labelB The label for the second set (default: `$B$`).

labelC (Not available for the 2 set version.) The label for the third set (default: `$C$`).

labelOnlyA The label for the region given by $A \setminus (B \cup C)$ (for 3 set version) or $A \setminus B$ (for 2 set version). (Default: empty.)

labelOnlyB The label for the region given by $B \setminus (A \cup C)$ (for 3 set version) or $B \setminus A$ (for 2 set version). (Default: empty.)

labelOnlyC (Not available for 2 set version.) The label for the region given by $C \setminus (A \cup B)$. (Default: empty.)

labelOnlyAB (Not available for 2 set version.) The label for the region given by $(A \cap B) \setminus C$. (Default: empty.)

labelOnlyAC (Not available for 2 set version.) The label for the region given by $(A \cap C) \setminus B$. (Default: empty.)

labelOnlyBC (Not available for 2 set version.) The label for the region given by $(B \cap C) \setminus A$. (Default: empty.)

labelABC (Not available for 2 set version.) The label for the region given by $A \cap B \cap C$. (Default: empty.)

labelNotABC (Not available for 2 set version.) The label for the region given by $(A \cup B \cup C)^c$. (Default: empty.)

labelAB (Not available for 3 set version.) The label for the region given by $A \cap B$. (Default: empty.)

labelNotAB (Not available for 3 set version.) The label for the region given by $(A \cup B)^c$. (Default: empty.)

radius The radius of each set. (Default: 1.2cm.)

hgap The horizontal gap between the outer vertical edge and the nearest set edge. (Default: 0.5cm.)

vgap The vertical gap between the outer horizontal edge and the nearest set edge. (Default: 0.5cm.)

overlap The overlap between the sets. (Default: 0.75cm.)

tikzoptions Any options to pass to tikzpicture.

Both environments draw the outline of the sets and the rectangular outline of the encompassing universal set. Within the Venn diagram environments commands are provided to shade various regions. (The commands have a cumulative effect, possibly drawing over each other. The set outlines and labels are drawn at the end of the environment.) Available commands are as follows:

`\fillA`

```
\fillA
```
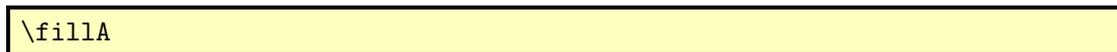
Shades set A.

`\fillB`

```
\fillB
```
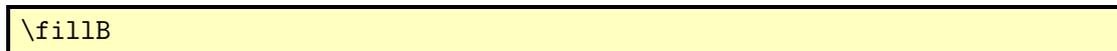
Shades set B.

`\fillC`

```
\fillC
```
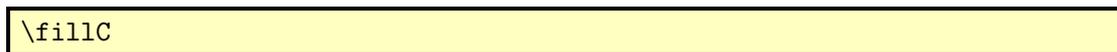
(Only for 3 set version.) Shades set C.

`\fillAll`

```
\fillAll
```
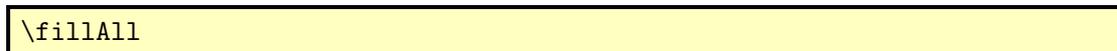
Shades the entire Venn diagram.

`\fillNotABC`

```
\fillNotABC
```

(Not available for 2 sets version.) Fills $(A \cup B \cup C)^c$.

`\fillOnlyA`

```
\fillOnlyA
```

Shades set $A \setminus (B \cup C)$ (for 3 sets version) or $A \setminus B$ (for 2 sets version).

`\fillOnlyB`

```
\fillOnlyB
```

Shades set $B \setminus (A \cup C)$ (for 3 sets version) or $B \setminus A$ (for 2 sets version).

`\fillOnlyC`

```
\fillOnlyC
```

(Not available for 2 sets version.) Shades $C \setminus (A \cup B)$.

`\fillNotA`

```
\fillNotA
```

Shades everything except A (that is A^c).

`\fillNotB`

```
\fillNotB
```

Shades everything except B (that is B^c).

`\fillNotC`

```
\fillNotC
```

(Not available for 2 set version.) Shades everything except C (that is C^c).

`\fillNotAorB`

```
\fillNotAorB
```

(Not available for 3 set version.) Shades $(A \cup B)^c$

`\fillNotAorNotB`

```
\fillNotAorNotB
```

(Not available for 3 set version.) Shades $(A \cap B)^c$

`\fillANotB`

```
\fillANotB
```

Shades $A \setminus B$.

`\fillBNotA`

```
\fillBNotA
```

Shades $B \setminus A$.

\fillANotC

```
\fillANotC
```

(Not available for 2 set version.) Shades $A \setminus C$.

\fillCNotA

```
\fillCNotA
```

(Not available for 2 set version.) Shades $C \setminus A$.

\fillBNotC

```
\fillBNotC
```

(Not available for 2 set version.) Shades $B \setminus C$.

\fillCNotB

```
\fillCNotB
```

(Not available for 2 set version.) Shades $C \setminus B$.

\fillACapB

```
\fillACapB
```

Shades $A \cap B$. (\fillBCapA is equivalent to \fillACapB.)

\fillACapC

```
\fillACapC
```

(Not available for 2 set version.) Shades $A \cap C$. (\fillCCapA is equivalent to \fillACapC.)

\fillBCapC

```
\fillBCapC
```

(Not available for 2 set version.) Shades $B \cap C$. (\fillCCapB is equivalent to \fillBCapC.)

\fillACapBNotC

```
\fillACapBNotC
```

(Not available for 2 set version.) Shades $A \cap B \setminus C$. (\fillBCapANotC is equivalent to \fillACapBNotC.)

\fillACapCNotB

```
\fillACapCNotB
```

(Not available for 2 set version.) Shades $A \cap C \setminus B$. (`\fillCCapANotB` is equivalent to `\fillACapCNotB`.)

`\fillBCapCNotA`

```
\fillBCapCNotA
```

(Not available for 2 set version.) Shades $B \cap C \setminus A$. (`\fillCCapBNotA` is equivalent to `\fillBCapCNotA`.)

`\fillACapBCapC`

```
\fillACapBCapC
```

(Not available for 2 set version.) Shades $A \cap B \cap C$. (Synonyms: `\fillACapCCapB`, `\fillBCapACapC`, `\fillBCapCCapA`, `\fillCCapACapB`, `\fillCCapBCapA`.)

`\setpostvennhook`

```
\setpostvennhook{⟨cmds⟩}
```

Sets the hook applied at the very end of the Venn diagram environments (after the outline and labels are drawn but before the end of the tikzpicture environment). The Venn diagram environments create coordinate nodes `venn bottom left`, `venn top left`, `venn top right` and `venn bottom right`, which may be referenced within the environment or in the hook.

The set labels may also be referenced *but only in* `\setpostvennhook`: `labelOnlyA`, `labelOnlyB`, `labelOnlyC` (three set version only), `labelNotABC` (three set version only), `labelNotAB` (two set version only), `labelA`, `labelB`, `labelC` (three set version only), `labelOnlyAB`, `labelOnlyAC` (three set version only), `labelOnlyBC` (three set version only) and `labelAB` (two set version only).

2 Examples

1. (Three sets) $A \cup B \cup C$

```
\begin{venndiagram3sets}
 \fillA \fillB \fillC
\end{venndiagram3sets}
```
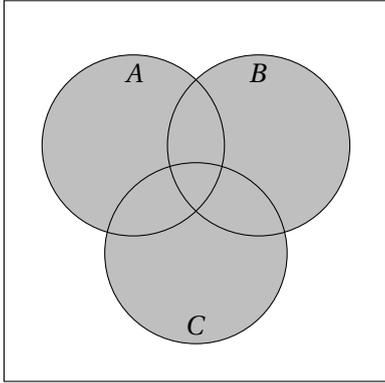
Produces:

2. (Two sets) $A \cup B$

```
\begin{venndiagram2sets}
 \fillA \fillB
\end{venndiagram2sets}
```

Produces:
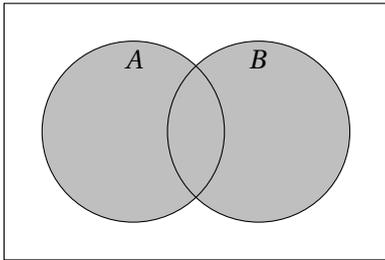
3. (Three sets) $A \setminus (B \cup C)$

```
\begin{venndiagram3sets}
 \fillOnlyA
\end{venndiagram3sets}
```
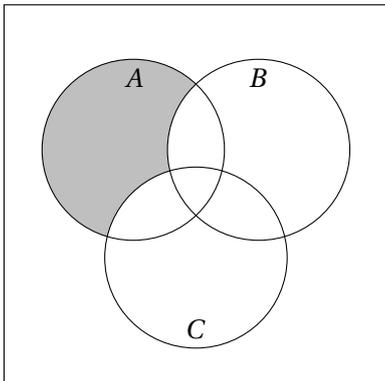
Produces:

4. (Two sets) $A \cap B$:

```
\begin{venndiagram2sets}
\fillACapB
\end{venndiagram2sets}
```
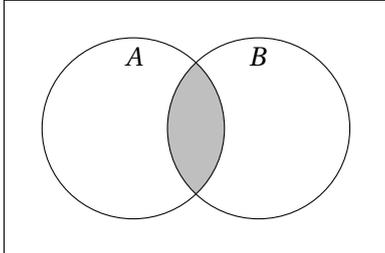

5. (Three sets) region labels:

```
\begin{venndiagram3sets}[labelOnlyA={1},labelOnlyB={2},labelOnlyC={3},
 labelOnlyAB={4},labelOnlyAC={5},labelOnlyBC={6},labelABC={7},
 labelNotABC={8}]
\end{venndiagram3sets}
```

Produces:
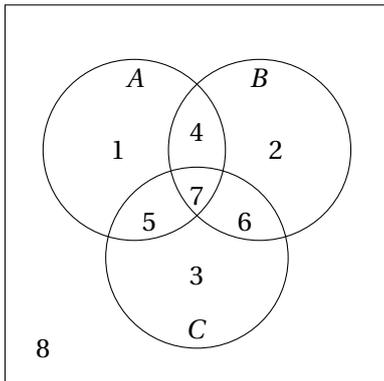
6. Annotating the diagram:

```
\begin{venndiagram3sets}[labelOnlyA={1},labelOnlyB={2},labelOnlyC={3},
 labelOnlyAB={4},labelOnlyAC={5},labelOnlyBC={6},labelABC={7},
 labelNotABC={8}]
\setpostvennhook
{
  \draw[<-] (labelA) -- ++(135:3cm) node[above] {Students who eat
artichokes};
  \draw[<-] (labelB) -- ++(45:3cm) node[above] {Students who eat
broccoli};
```

```
    \draw[<-] (labelC) -- ++(-90:3cm) node[below] {Students who eat
carrots};
    \draw[<-] (labelABC) -- ++(0:3cm)
      node[right,text width=4cm,align=flush left]
     {7 students eat artichokes, broccoli and carrots};
    \draw[<-] (labelNotABC) -- ++(-135:3cm)
      node[below,text width=4cm,align=flush left]
     {8 students don't eat artichokes, broccoli or carrots};
}
\end{venndiagram3sets}
```

Produces:
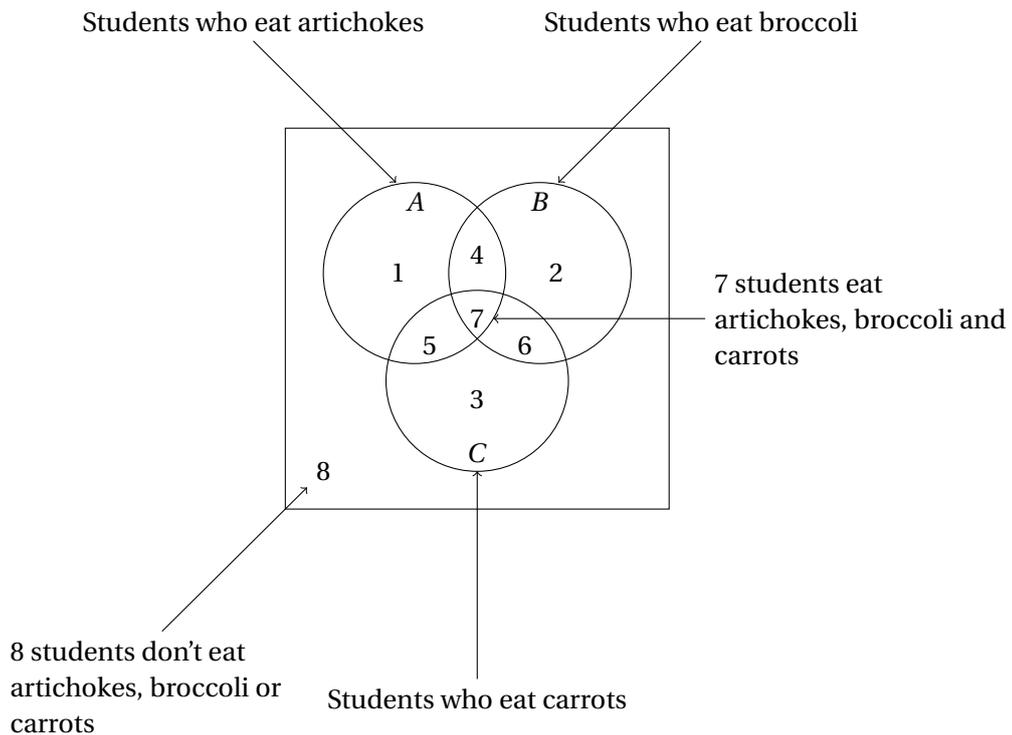
3 The Code

Package identification:

```
1 \NeedsTeXFormat{LaTeX2e}
2 \ProvidesPackage{venndiagram}[2016/03/16 v1.1 (NLCT) Venn diagrams]
```

Required packages:

```
3 \RequirePackage{xkeyval}
4 \RequirePackage{tikz}
5 \RequirePackage{etoolbox}
```

TiKZ intersections library no longer needed. (Removed in v1.1)

The pgf package reversed the order of arguments of `atan2` in v3.0, which messes things up a bit. In the event that there are users with older versions of pgf, backward-compatibility is required. Add a switch to determine which syntax to use.

`\ifvennoldpgf` If true use old syntax.

```
6 \newif\ifvennoldpgf
```

Try to determine this setting.

```
7 \ifdef\pgfversion
8 {
9   \def\@venn@checkversion#1.#2\@venn@end@checkversion{%
10   \ifnum#1<3 \vennoldpgftrue \else \vennoldpgffalse\fi}
11   \expandafter\@venn@checkversion\pgfversion.0\@venn@end@checkversion
12 }
13 {
14   \vennoldpgftrue
15 }
```

3.1 Initialising the Default Values

Set up macros used by the keys for the Venn diagram options. First the default set labels.

`\@venn@label@A` Set A:

```
16 \newcommand*{\@venn@label@A}{$A$}
```

`\@venn@label@B` Set B:

```
17 \newcommand*{\@venn@label@B}{$B$}
```

`\@venn@label@C` Set C:

```
18 \newcommand*{\@venn@label@C}{$C$}
```

`\@venn@shade` The colour used to shade regions.

```
19 \newcommand*{\@venn@shade}{lightgray}
```

The default labels for all the other regions are empty.

`enn@label@OnlyA` Only set A:

```
20 \newcommand*{\@venn@label@OnlyA}{}
```

`enn@label@OnlyB` Only set B:

```
21 \newcommand*{\@venn@label@OnlyB}{}
```

`enn@label@OnlyC` Only set C:

```
22 \newcommand*{\@venn@label@OnlyC}{}
```

`nn@label@OnlyAB` Sets A and B but not C:

```
23 \newcommand*{\@venn@label@OnlyAB}{}
```

nn@label@OnlyAC	Sets *A* and *C* but not *B*:	

24 \newcommand*{\@venn@label@OnlyAC}{}

nn@label@OnlyBC	Sets *B* and *C* but not *A*:	

25 \newcommand*{\@venn@label@OnlyBC}{}

@venn@label@ABC Intersection of sets *A*, *B* and *C*:

26 \newcommand*{\@venn@label@ABC}{}

nn@label@NotABC Everything except *A*, *B* or *C*:

27 \newcommand*{\@venn@label@NotABC}{}

enn@label@NotAB Everything except *A* or *B* (two set version only):

28 \newcommand*{\@venn@label@NotAB}{}

\@venn@label@AB Intersection of *A* and *B* (two set version only):

29 \newcommand*{\@venn@label@AB}{}

Now the default dimensions of the diagrams.

\@venn@radius The radius of the sets.

30 \newcommand*{\@venn@radius}{1.2cm}

\@venn@hgap The horizontal distance between the edge of the diagram and the outer edge of the nearest set.

31 \newcommand*{\@venn@hgap}{0.5cm}

\@venn@vgap

32 % The vertical distance between the edge of the diagram and the
33 % outer edge of the nearest set.
34 \newcommand*{\@venn@vgap}{0.5cm}

\@venn@overlap The size of the set overlap.

35 \newcommand*{\@venn@overlap}{0.75cm}

enn@tikzoptions Any options to be passed to the tikzpicture environment.

36 \newcommand*{\@venn@tikzoptions}{}

Lengths to store the centres of the sets and the overall width and height of the diagram.

\@venn@Ax The x-coordinate of set *A*:

37 \newlength\@venn@Ax

\@venn@Ay The y-coordinate of set *A*:

38 \newlength\@venn@Ay

\@venn@Bx The x-coordinate of set *B*:

39 \newlength\@venn@Bx

\@venn@By	The *y*-coordinate of set *B*:

40 `\newlength\@venn@By`

\@venn@Cx · The *x*-coordinate of set *C*:

41 `\newlength\@venn@Cx`

\@venn@Cy · The *y*-coordinate of set *C*:

42 `\newlength\@venn@Cy`

\@venn@w · The width of the entire Venn diagram.

43 `\newlength\@venn@w`

\@venn@h · The height of the entire Venn diagram.

44 `\newlength\@venn@h`

3.2 Defining the key=value Options

Now define the keys for the optional argument of venndiagram2sets and venndiagram3sets. They are all in the family venn.

shade · Option to set the shading.

45 `\define@key{venn}{shade}{\def\@venn@shade{#1}}`

labelA · Option to set the label for set *A*.

46 `\define@key{venn}{labelA}{\def\@venn@label@A{#1}}`

labelB · Option to set the label for set *B*.

47 `\define@key{venn}{labelB}{\def\@venn@label@B{#1}}`

labelC · Option to set the label for set *C*.

48 `\define@key{venn}{labelC}{\def\@venn@label@C{#1}}`

Now for the region labels.

labelOnlyA · Option to set the label for only set *A*.

49 `\define@key{venn}{labelOnlyA}{\def\@venn@label@OnlyA{#1}}`

labelOnlyB · Option to set the label for only set *B*.

50 `\define@key{venn}{labelOnlyB}{\def\@venn@label@OnlyB{#1}}`

labelOnlyC · Option to set the label for only set *C*.

51 `\define@key{venn}{labelOnlyC}{\def\@venn@label@OnlyC{#1}}`

labelOnlyAB · Option to set the label for the intersection of *A* and *B*.

52 `\define@key{venn}{labelOnlyAB}{\def\@venn@label@OnlyAB{#1}}`

`labelOnlyAC`	Option to set the label for the intersection of *A* and *C*.
	53 `\define@key{venn}{labelOnlyAC}{\def\@venn@label@OnlyAC{#1}}`
`labelOnlyBC`	Option to set the label for the intersection of *B* and *C*.
	54 `\define@key{venn}{labelOnlyBC}{\def\@venn@label@OnlyBC{#1}}`
`labelABC`	Option to set the label for the intersection of *A*, *B* and *C*. (Three set version only)
	55 `\define@key{venn}{labelABC}{\def\@venn@label@ABC{#1}}`
`labelNotABC`	Option to set the label for the region outside the three sets. (Three set version only)
	56 `\define@key{venn}{labelNotABC}{\def\@venn@label@NotABC{#1}}`
`labelAB`	Option to set the label for the intersection of *A* and *B*. (Two set version only)
	57 `\define@key{venn}{labelAB}{\def\@venn@label@AB{#1}}`
`labelNotAB`	Option to set the label for the region outside the two sets. (Two set version only)
	58 `\define@key{venn}{labelNotAB}{\def\@venn@label@NotAB{#1}}`

Now for the dimension options.

`radius`	Option to set the radius.
	59 `\define@key{venn}{radius}{\def\@venn@radius{#1}}`
`hgap`	Option to set the horizontal gap between the outer edge of the diagram and the nearest set edge.
	60 `\define@key{venn}{hgap}{\def\@venn@hgap{#1}}`
`vgap`	Option to set the vertical gap between the outer edge of the diagram and the nearest set edge.
	61 `\define@key{venn}{vgap}{\def\@venn@vgap{#1}}`
`overlap`	Option to set the set overlap.
	62 `\define@key{venn}{overlap}{\def\@venn@overlap{#1}}`

Finally the option to set the information to pass to the tikzpicture environment.

`tikzoptions`	
	63 `\define@key{venn}{tikzoptions}{\def\@venn@tikzoptions{#1}}`

3.3 Circle Intersection

Previously commands like `\fillOnlyA` used pgf path operations to compute the intersection points of the circles, but the code didn't work properly when the co-ordinate system has been scaled. Version 1.1 changes this to calculate the co-ordinates in a more low-level way. We have two circles centred on (a_x, a_y) and (b_x, b_y) both with radius r. This gives the equations:

$$(x - a_x)^2 + (y - a_y)^2 = r^2 \tag{1}$$

$$(x - b_x)^2 + (y - b_y)^2 = r^2 \tag{2}$$

Combining:
$$(x - a_x)^2 - (x - b_x)^2 + (y - a_y)^2 - (y - b_y)^2 = 0 \qquad (3)$$

Re-arranging gives the equation of the chord between the two points of intersection:

$$x(b_x - a_x) + y(b_y - a_y) = \frac{b_x^2 - a_x^2 + b_y^2 - a_y^2}{2}$$

Special cases:

1. $b_x = a_x$ (circles vertically stacked):

$$y(b_y - a_y) = \frac{b_y^2 - a_y^2}{2}$$

Rearranging gives $y = \frac{1}{2}(b_y + a_y)$. Substituting into (1):

$$(x - a_x)^2 + \left(\frac{1}{2}(b_y + a_y) - a_y\right)^2 = r^2$$

$$(x - a_x)^2 + \frac{1}{4}(b_y - a_y)^2 = r^2$$

$$x^2 - 2xa_x + a_x^2 + \frac{(b_y - a_y)^2}{4} - r^2 = 0$$

This is a quadratic equation in x with solutions given by

$$x = a_x \pm \sqrt{a_x^2 - \left(a_x^2 + \frac{(b_y - a_y)^2}{4} - r^2\right)}$$

$$= a_x \pm \sqrt{r^2 - \frac{1}{4}(b_y - a_y)^2}$$

If $r^2 < \frac{1}{4}(b_y - a_y)^2$ then no solution exists (circles don't overlap). If $r^2 = \frac{1}{4}(b_y - a_y)^2$ then there's only one point of intersection.

2. $b_y = a_y$ (circles horizontally aligned):

$$x(b_x - a_x) = \frac{b_x^2 - a_x^2}{2}$$

Rearranging gives $x = \frac{1}{2}(b_x + a_x)$. Substituting into (1):

$$\left(\frac{b_x + a_x}{2} - a_x\right)^2 + (y - a_y)^2 = r^2$$

$$\frac{1}{4}(b_x - a_x)^2 + (y - a_y)^2 = r^2$$

$$y^2 - 2ya_y + a_y^2 + \frac{1}{4}(b_x - a_x)^2 - r^2 = 0$$

This is a quadratic equation in y with solutions given by

$$y = a_y \pm \sqrt{a_y^2 - \left(a_y^2 + \frac{(b_x - a_x)^2}{4} - r^2\right)}$$

$$= a_y \pm \sqrt{r^2 - \frac{1}{4}(b_x - a_x)^2}$$

If $r^2 < \frac{1}{4}(b_x - a_x)^2$ then no solution exists (circles don't overlap). If $r^2 = \frac{1}{4}(b_x - a_x)^2$ then there's only one point of intersection.

The general case has the chord given by equation (3), which can be rewritten in the form $y = mx + c$ where

$$m = \frac{a_x - b_x}{b_y - a_y}$$

$$c = \frac{b_x^2 - a_x^2 + b_y^2 - a_y^2}{2(b_y - a_y)}$$

Substituting into equation (1):

$$(x - a_x)^2 + ((mx + c) - a_y)^2 = r^2$$

Rearranging:

$$(1 + m^2)x^2 + 2x(mc - a_x - a_y m) + a_x^2 + c^2 - 2a_y c + a_y^2 - r^2 = 0$$

This is a quadratic solution in x with solutions given by

$$x = \frac{-(mc - a_x - a_y m) \pm \sqrt{(mc - a_x - a_y m)^2 - (1 + m^2)(a_x^2 + c^2 - 2a_y c + a_y^2 - r^2)}}{1 + m^2}$$

Provide command to compute the intersection of two circles of the same radius (given by \@venn@radius.

ircleintersects The four arguments are a_x, a_y, b_x and b_y (the centre co-ordinates in lengths). The results are stored in \@venn@intersect@i@x, \@venn@intersect@i@y, \@venn@intersect@ii@x and \@venn@intersect@ii@y. The number of intersects (0, 1 or 2) is stored in \@venn@intersect@n.

```
64 \newcommand*{\@venn@computecircleintersects}[4]{%
65   \ifdim#1=#3\relax
```

Case 1 ($a_x = b_x$). Compute $y = \frac{1}{2}(b_y + a_y)$.

```
66   \pgfmathsetlength{\@venn@intersect@i@y}{0.5*(#4+#2)}%
67   \setlength{\@venn@intersect@ii@y}{\@venn@intersect@i@y}%
```

Compute $r^2 - \frac{1}{4}(b_y - a_y)^2$

```
68   \pgfmathsetlength{\dimen@i}{#4-#2}%
69   \pgfmathsetlength{\dimen@}{\@venn@radius*\@venn@radius-0.25*\dimen@i*\dimen@i}%
70   \setlength{\@venn@intersect@i@x}{#1}%
71   \setlength{\@venn@intersect@ii@x}{#1}%
72   \ifdim\dimen@=0pt\relax
```

One point of intersection.

```
73    \def\@venn@intersect@n{1}%
74  \else
75    \ifdim\dimen@>0pt\relax
```

Two points of intersection.

```
76      \def\@venn@intersect@n{2}%
77      \pgfmathsetlength{\dimen@i}{sqrt(\dimen@)}%
78      \addtolength{\@venn@intersect@i@x}{\dimen@i}%
79      \addtolength{\@venn@intersect@ii@x}{-\dimen@i}%
80    \else
```

No intersection.

```
81      \def\@venn@intersect@n{0}%
82    \fi
83  \fi
84 \else
85   \ifdim#2=#4\relax
```

Case 2 ($a_y = b_y$). Compute $x = \frac{1}{2}(b_x + a_x)$

```
86     \pgfmathsetlength{\@venn@intersect@i@x}{0.5*(#3+#1)}%
87     \setlength{\@venn@intersect@ii@x}{\@venn@intersect@i@x}%
```

Compute $r^2 - \frac{1}{4}(b_x - a_x)^2$

```
88     \setlength{\dimen@i}{#3}%
89     \addtolength{\dimen@i}{-#1}%
90     \pgfmathsetlength{\dimen@}{\@venn@radius*\@venn@radius
91       -0.25*\dimen@i*\dimen@i}%
92     \setlength{\@venn@intersect@i@y}{#2}%
93     \setlength{\@venn@intersect@ii@y}{#2}%
94     \ifdim\dimen@=0pt\relax
```

One point of intersection.

```
95       \def\@venn@intersect@n{1}%
96     \else
97       \ifdim\dimen@>0pt\relax
```

Two points of intersection.

```
98         \def\@venn@intersect@n{2}%
99         \pgfmathsetlength{\dimen@i}{sqrt(\dimen@)}%
100        \addtolength{\@venn@intersect@i@y}{\dimen@i}%
101        \addtolength{\@venn@intersect@ii@y}{-\dimen@i}%
102      \else
```

No intersection.

```
103        \def\@venn@intersect@n{0}%
104      \fi
105    \fi
106   \else
```

General case. Convert all lengths to scalar to reduce chances of exceeding max dimension.
Using inches to ensure more reasonable values.

```
107    \pgfmathparse{#1/72.27}\let\@vnn@ax\pgfmathresult
108    \pgfmathparse{#2/72.27}\let\@vnn@ay\pgfmathresult
109    \pgfmathparse{#3/72.27}\let\@vnn@bx\pgfmathresult
110    \pgfmathparse{#4/72.27}\let\@vnn@by\pgfmathresult
111    \pgfmathparse{\@venn@radius/72.27}\let\@vnn@r\pgfmathresult
112    \pgfmathparse{\@vnn@ax*\@vnn@ax}\let\@vnn@ax@sq\pgfmathresult
113    \pgfmathparse{\@vnn@ay*\@vnn@ay}\let\@vnn@ay@sq\pgfmathresult
114    \pgfmathparse{\@vnn@bx*\@vnn@bx}\let\@vnn@bx@sq\pgfmathresult
115    \pgfmathparse{\@vnn@by*\@vnn@by}\let\@vnn@by@sq\pgfmathresult
116    \pgfmathparse{\@vnn@r*\@vnn@r}\let\@vnn@r@sq\pgfmathresult
```

Set
$$c = \frac{b_x^2 - a_x^2 + b_y^2 - a_y^2}{2(b_y - a_y)}$$

```
117    \pgfmathparse{0.5*(\@vnn@bx@sq-\@vnn@ax@sq+\@vnn@by@sq-\@vnn@ay@sq)
118      /(\@vnn@by-\@vnn@ay)}%
119    \let\@vnn@c\pgfmathresult
```

Set
$$m = \frac{a_x - b_x}{b_y - a_y}$$

```
120    \pgfmathparse{(\@vnn@ax-\@vnn@bx)/(\@vnn@by-\@vnn@ay)}%
121    \let\@vnn@m\pgfmathresult
```

Compute $(1 + m^2)$.

```
122    \pgfmathparse{1+\@vnn@m*\@vnn@m}%
123    \let\@vnn@one@plus@m@sq\pgfmathresult
```

Compute
$$mc - a_x - a_y m = m(c - a_y) - a_x$$

```
124    \pgfmathparse{\@vnn@m*(\@vnn@c-\@vnn@ay)-\@vnn@ax}%
125    \let\@vnn@b\pgfmathresult
```

Denote this value b and now compute
$$b^2 - (1 + m^2)(a_x^2 + a_y^2 + c^2 - 2a_y c - r^2)$$

```
126    \pgfmathparse{\@vnn@b*\@vnn@b
127      - \@vnn@one@plus@m@sq
128      *(\@vnn@ax@sq+\@vnn@ay@sq+\@vnn@c*\@vnn@c
129        -2*\@vnn@ay*\@vnn@c-\@vnn@r@sq)}%
130    \let\@vnn@root\pgfmathresult
131    \setlength\dimen@{\pgfmathresult in}%
132    \ifdim\dimen@=0pt\relax
```

One point of intersection.

```
133      \def\@venn@intersect@n{1}%
```

$$x_1 = \frac{-b}{1 + m^2}$$

```
134      \pgfmathparse{-\@vnn@b/\@vnn@one@plus@m@sq}%
135      \setlength{\@venn@intersect@i@x}{\pgfmathresult in}%
136      \setlength{\@venn@intersect@ii@x}{\@venn@intersect@i@x}%
```

$$y_1 = mx_1 + c$$

```
137        \pgfmathparse{\pgfmathresult*\@vnn@m+c}%
138        \setlength{\@venn@intersect@i@y}{\pgfmathresult in}%
139        \setlength{\@venn@intersect@ii@y}{\@venn@intesect@i@y}%
140      \else
141        \ifdim\dimen@>0pt\relax
```

Two points of intersection.

```
142          \def\@venn@intersect@n{2}%
143          \pgfmathsqrt{\@vnn@root}%
144          \let\@vnn@root\pgfmathresult
```

First point.

```
145          \pgfmathparse{(-\@vnn@b+\@vnn@root)/\@vnn@one@plus@m@sq}%
146          \setlength{\@venn@intersect@i@x}{\pgfmathresult in}%
147          \pgfmathparse{\pgfmathresult*\@vnn@m+\@vnn@c}%
148          \setlength{\@venn@intersect@i@y}{\pgfmathresult in}%
```

Second point.

```
149          \pgfmathparse{(-\@vnn@b-\@vnn@root)/\@vnn@one@plus@m@sq}%
150          \setlength{\@venn@intersect@ii@x}{\pgfmathresult in}%
151          \pgfmathparse{\pgfmathresult*\@vnn@m+\@vnn@c}%
152          \setlength{\@venn@intersect@ii@y}{\pgfmathresult in}%
153        \else
```

No intersection.

```
154          \def\@venn@intersect@n{0}%
155        \fi
156      \fi
157    \fi
158  \fi
159 }
```

```
160 \newlength\@venn@intersect@i@x
```

```
161 \newlength\@venn@intersect@i@y
```

```
162 \newlength\@venn@intersect@ii@x
```

```
163 \newlength\@venn@intersect@ii@y
```

3.4 Environment Definitions

Environment to draw Venn diagram with three sets.

```
164 \newenvironment{venndiagram3sets}[1][]%
165 {%
```

Disable the keys that aren't applicable.

```
166   \disable@keys{venn}{labelAB,labelNotAB}%
```

Set the key values given in the optional argument.

```
167   \setkeys{venn}{#1}%
```

Calculate centre of set *C*

```
168   \pgfmathsetlength{\@venn@Cx}{\@venn@hgap + 2*\@venn@radius
169     -0.5*\@venn@overlap}%
170   \pgfmathsetlength{\@venn@Cy}{\@venn@vgap+\@venn@radius}%
```

Calculate centre of set *A*

```
171   \pgfmathsetlength{\@venn@Ax}{\@venn@hgap+\@venn@radius}%
172   \pgfmathsetlength{\@venn@Ay}{\@venn@Cy
173     + (\@venn@radius - 0.5*\@venn@overlap)*1.73205}%
```

Calculate centre of set *B*

```
174   \pgfmathsetlength{\@venn@Bx}{\@venn@hgap+3*\@venn@radius
175     -\@venn@overlap}%
176   \setlength{\@venn@By}{\@venn@Ay}%
```

Compute dimensions of entire diagram

```
177   \pgfmathsetlength{\@venn@w}{2*\@venn@hgap+4*\@venn@radius
178       -\@venn@overlap}%
179   \pgfmathsetlength{\@venn@h}{2*\@venn@vgap+4*\@venn@radius
180       -\@venn@overlap}%
```

Define filling commands. Fill all of set *A*:

```
181   \def\fillA{\path[fill=\@venn@shade] (\@venn@Ax,\@venn@Ay)
182     circle (\@venn@radius);}%
```

Fill all of set *B*:

```
183   \def\fillB{\path[fill=\@venn@shade] (\@venn@Bx,\@venn@By)
184     circle (\@venn@radius);}%
```

Fill all of set *C*:

```
185   \def\fillC{\path[fill=\@venn@shade] (\@venn@Cx,\@venn@Cy)
186     circle (\@venn@radius);}%
```

Fill everything:

```
187   \def\fillAll{\path[fill=\@venn@shade] (0,0)
188     rectangle (\@venn@w,\@venn@h);}%
```

Fill everything except set *A*:

```
189   \def\fillNotA{\path[fill=\@venn@shade,even odd rule]
190     (0,0) rectangle (\@venn@w,\@venn@h)
191     (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);}%
```

Fill everything except set *B*:

```
192   \def\fillNotB{\path[fill=\@venn@shade,even odd rule]
193     (0,0) rectangle (\@venn@w,\@venn@h)
194     (\@venn@Bx,\@venn@By) circle (\@venn@radius);}%
```

Fill everything except set *C*:

```
195  \def\fillNotC{\path[fill=\@venn@shade,even odd rule]
196    (0,0) rectangle (\@venn@w,\@venn@h)
197    (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);}%
```

Fill only set *A*.

```
198  \let\fillOnlyA\@venn@fillOnlyA@threesets
```

Fill only set *B*:

```
199  \let\fillOnlyB\@venn@fillOnlyB@threesets
```

Fill only set *C*:

```
200  \let\fillOnlyC\@venn@fillOnlyC@threesets
```

Fill everything except *A*, *B* or *C*.

```
201  \let\fillNotABC\@venn@fillNotABC@threesets
```

Fill *A* but not *B*

```
202  \def\fillANotB{%
203    \begin{scope}
204      \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
205      \path[fill=\@venn@shade,even odd rule]
206        (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
207        (\@venn@Bx,\@venn@By) circle (\@venn@radius);
208    \end{scope}
209  }%
```

Fill *B* but not *A*

```
210  \def\fillBNotA{%
211    \begin{scope}
212      \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
213      \path[fill=\@venn@shade,even odd rule]
214        (\@venn@Bx,\@venn@By) circle (\@venn@radius)
215        (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
216    \end{scope}
217  }%
```

Fill *A* but not *C*

```
218  \def\fillANotC{%
219    \begin{scope}
220      \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
221      \path[fill=\@venn@shade,even odd rule]
222        (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
223        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
224    \end{scope}
225  }%
```

Fill *C* but not *A*

```
226  \def\fillCNotA{%
227    \begin{scope}
228      \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
229      \path[fill=\@venn@shade,even odd rule]
```

```
230        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius)
231        (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
232    \end{scope}
233  }%
```

Fill *B* but not *C*

```
234  \def\fillBNotC{%
235    \begin{scope}
236      \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
237      \path[fill=\@venn@shade,even odd rule]
238        (\@venn@Bx,\@venn@By) circle (\@venn@radius)
239        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
240    \end{scope}
241  }%
```

Fill *C* but not *B*

```
242  \def\fillCNotB{%
243    \begin{scope}
244      \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
245      \path[fill=\@venn@shade,even odd rule]
246        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius)
247        (\@venn@Bx,\@venn@By) circle (\@venn@radius);
248    \end{scope}
249  }%
```

Fill *A* intersect *B*

```
250  \def\fillACapB{%
251    \begin{scope}
252      \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
253      \path[fill=\@venn@shade]
254        (\@venn@Bx,\@venn@By) circle (\@venn@radius);
255    \end{scope}
256  }%
```

Define a synonym:

```
257  \let\fillBCapA\fillACapB
```

Fill *A* intersect *C*

```
258  \def\fillACapC{%
259    \begin{scope}
260      \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
261      \path[fill=\@venn@shade]
262        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
263    \end{scope}
264  }%
```

Define a synonym:

```
265  \let\fillCCapA\fillACapC
```

Fill *B* intersect *C*

```
266  \def\fillBCapC{%
267    \begin{scope}
```

```
268      \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
269      \path[fill=\@venn@shade]
270        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
271    \end{scope}
272  }%
```

Define a synonym:

```
273  \let\fillCCapB\fillBCapC
```

Fill *A* intersect *B* but not *C*

```
274  \def\fillACapBNotC{%
275    \begin{scope}
276      \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
277      \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
278      \path[fill=\@venn@shade,even odd rule]
279        (\@venn@Bx,\@venn@By) circle (\@venn@radius)
280        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
281    \end{scope}
282  }%
```

Define a synonym:

```
283  \let\fillBCapANotC\fillACapBNotC
```

Fill *A* intersect *C* but not *B*

```
284  \def\fillACapCNotB{%
285    \begin{scope}
286      \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
287      \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
288      \path[fill=\@venn@shade,even odd rule]
289        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius)
290        (\@venn@Bx,\@venn@By) circle (\@venn@radius);
291    \end{scope}
292  }%
```

Define a synonym:

```
293  \let\fillCCapANotB\fillACapCNotB
```

Fill *B* intersect *C* but not *A*

```
294  \def\fillBCapCNotA{%
295    \begin{scope}
296      \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
297      \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
298      \path[fill=\@venn@shade,even odd rule]
299        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius)
300        (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
301    \end{scope}
302  }%
```

Define a synonym:

```
303  \let\fillCCapBNotA\fillBCapCNotA
```

Fill the intersection of all three sets

```
304    \def\fillACapBCapC{%
305      \begin{scope}
306        \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
307        \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
308        \path[fill=\@venn@shade]
309          (\@venn@Bx,\@venn@By) circle (\@venn@radius);
310      \end{scope}
311    }%
```

Define synonyms:

```
312    \let\fillACapCCapB\fillACapBCapC
313    \let\fillBCapACapC\fillACapBCapC
314    \let\fillBCapCCapA\fillACapBCapC
315    \let\fillCCapACapB\fillACapBCapC
316    \let\fillCCapBCapA\fillACapBCapC
```

Start the tikzpicture environment.

```
317    \ifdefempty{\@venn@tikzoptions}%
318    {%
319      \def\@venn@dobegin{\begin{tikzpicture}}%
320    }%
321    {%
322      \edef\@venn@dobegin{\noexpand\begin{tikzpicture}%
323          [\expandonce\@venn@tikzoptions]}%
324    }%
325    \@venn@dobegin
```

coordinates of the Venn diagram corners

```
326    \path (0,0) coordinate (venn bottom left)
327        (0,\@venn@h) coordinate (venn top left)
328        (\@venn@w,\@venn@h) coordinate (venn top right)
329        (\@venn@w,0) coordinate (venn bottom right);
330  }%
```

End environment code:

```
331  {%
```

Draw outlines

```
332      \draw (0,0) rectangle (\@venn@w,\@venn@h);
333      \draw (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
334      \draw (\@venn@Bx,\@venn@By) circle (\@venn@radius);
335      \draw (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
```

Draw labels

```
336      \draw (\@venn@Ax,\@venn@Ay) node[above,left] (labelOnlyA) {\@venn@label@OnlyA};
337      \draw (\@venn@Bx,\@venn@By) node[above,right] (labelOnlyB) {\@venn@label@OnlyB};
338      \draw (\@venn@Cx,\@venn@Cy) node[below] (labelOnlyC) {\@venn@label@OnlyC};
```

Region labels

```
339      \draw (\@venn@vgap,\@venn@hgap) node (labelNotABC) {\@venn@label@NotABC};
340      \draw (\@venn@Ax,\@venn@Ay+\@venn@radius)
341        node[below] (labelA) {\@venn@label@A};
```

```
342        \draw (\@venn@Bx,\@venn@By+\@venn@radius)
343          node[below] (labelB) {\@venn@label@B};
344        \draw (\@venn@Cx,\@venn@vgap) node[above] (labelC) {\@venn@label@C};
345        \draw (\@venn@Cx,0.5*\@venn@h) node (labelABC) {\@venn@label@ABC};
346        \draw (\@venn@Cx,\@venn@Ay) node[above] (labelOnlyAB) {\@venn@label@OnlyAB};
347        \draw (\@venn@Ax,\@venn@Ay) ++(-60:\@venn@radius-0.5*\@venn@overlap)
348          node[below left] (labelOnlyAC) {\@venn@label@OnlyAC};
349        \draw (\@venn@Bx,\@venn@By) ++(-120:\@venn@radius-0.5*\@venn@overlap)
350          node[below right] (labelOnlyBC) {\@venn@label@OnlyBC};
351        \@postvennhook
352      \end{tikzpicture}
353 }
```

\@postvennhook   Hook called just before the end of the tikzpicture environment.

```
354 \newcommand*{\@postvennhook}{}
```

setpostvennhook   User interface to set the post hook.

```
355 \newcommand*{\setpostvennhook}[1]{\def\@postvennhook{#1}}
```

OnlyA@threesets   \fillOnlyA is set to this for the three set version. Reimplemented in v1.1 to use new circle
                  intersect code.

```
356 \newcommand*\@venn@fillOnlyA@threesets{%
```

Get the intersection points between *A* and *B*.

```
357        \@venn@computecircleintersects{\@venn@Ax}{\@venn@Ay}{\@venn@Bx}{\@venn@By}%
```

If there aren't two points of intersection, then the circles don't overlap.

```
358        \ifnum\@venn@intersect@n=2\relax
```

We need the point that's furthest from *C*.

```
359          \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@i@x}%
360          \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@i@y}%
361          \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
362          \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@ii@x}%
363          \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@ii@y}%
364          \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
365          \ifdim\dimen@>\dimen@i
366            \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
367            \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
368            \edef\@venn@start@pt@x{\the\@venn@intersect@i@x}%
369            \edef\@venn@start@pt@y{\the\@venn@intersect@i@y}%
370          \else
371            \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
372            \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
373            \edef\@venn@start@pt@x{\the\@venn@intersect@ii@x}%
374            \edef\@venn@start@pt@y{\the\@venn@intersect@ii@y}%
375          \fi
```

Compute the initial angle of the first arc.

```
376        \ifvennoldpgf
```

```
377        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
378      \else
379        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
380      \fi
381      \let\@venn@start@i@angle\pgfmathresult
```

Compute the intersection between *A* and *C*.

```
382      \@venn@computecircleintersects{\@venn@Ax}{\@venn@Ay}{\@venn@Cx}{\@venn@Cy}%
```

Need the point furthest from *B*.

```
383      \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@i@x}%
384      \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@i@y}%
385      \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
386      \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@ii@x}%
387      \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@ii@y}%
388      \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
389      \ifdim\dimen@>\dimen@i
390        \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
391        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
392        \edef\@venn@end@pt@i@x{\the\@venn@intersect@i@x}%
393        \edef\@venn@end@pt@i@y{\the\@venn@intersect@i@y}%
394      \else
395        \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
396        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
397        \edef\@venn@end@pt@i@x{\the\@venn@intersect@ii@x}%
398        \edef\@venn@end@pt@i@y{\the\@venn@intersect@ii@y}%
399      \fi
```

Compute the end angle of the first arc.

```
400      \ifvennoldpgf
401        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
402      \else
403        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
404      \fi
405      \let\@venn@end@i@angle\pgfmathresult
406      \pgfmathadd{\@venn@end@i@angle}{360}%
407      \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle of the second arc.

```
408      \pgfmathsetlength{\dimen@i}{\@venn@end@pt@i@x-\@venn@Cx}%
409      \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@i@y-\@venn@Cy}%
410      \ifvennoldpgf
411        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
412      \else
413        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
414      \fi
415      \let\@venn@start@ii@angle\pgfmathresult
```

Compute the intersection between *B* and *C*.

```
416      \@venn@computecircleintersects{\@venn@Bx}{\@venn@By}{\@venn@Cx}{\@venn@Cy}%
```

Need the point closest to *A*.

```
417        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@i@x}%
418        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@i@y}%
419        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
420        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@ii@x}%
421        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@ii@y}%
422        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
423        \ifdim\dimen@<\dimen@i
424          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%
425          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%
426          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@i@x}%
427          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@i@y}%
428        \else
429          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%
430          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%
431          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@ii@x}%
432          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@ii@y}%
433        \fi
```

Compute the end angle of the second arc.

```
434        \ifvennoldpgf
435          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
436        \else
437          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
438        \fi
439        \let\@venn@end@ii@angle\pgfmathresult
```

Compute the start angle of the third arc.

```
440        \pgfmathsetlength{\dimen@i}{\@venn@end@pt@ii@x-\@venn@Bx}%
441        \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@ii@y-\@venn@By}%
442        \ifvennoldpgf
443          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
444        \else
445          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
446        \fi
447        \let\@venn@start@iii@angle\pgfmathresult
```

Compute the end angle of the third arc.

```
448        \pgfmathsetlength{\dimen@i}{\@venn@start@pt@x-\@venn@Bx}%
449        \pgfmathsetlength{\dimen@ii}{\@venn@start@pt@y-\@venn@By}%
450        \ifvennoldpgf
451          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
452        \else
453          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
454        \fi
455        \let\@venn@end@iii@angle\pgfmathresult
456        \pgfmathsubtract{\@venn@end@iii@angle}{360}%
457        \let\@venn@end@iii@angle\pgfmathresult
```

Fill path

```
458        \path[fill=\@venn@shade] (\@venn@start@pt@x,\@venn@start@pt@y)
459        arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
```

```
460        end angle=\@venn@end@i@angle]
461        arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
462        end angle=\@venn@end@ii@angle]
463        arc[radius=\@venn@radius,start angle=\@venn@start@iii@angle,
464        end angle=\@venn@end@iii@angle] -- cycle;
465      \else
466        \fillOnlyA
467      \fi
468 }%
```

OnlyB@threesets   \fillOnlyB is set to this for the three set version. Reimplemented in v1.1 to use new circle
                  intersect code.

```
469 \newcommand*\@venn@fillOnlyB@threesets{%
```

Get the intersection points between *B* and *A*.

```
470        \@venn@computecircleintersects{\@venn@Bx}{\@venn@By}{\@venn@Ax}{\@venn@Ay}%
```

If there aren't two points of intersection, then the circles don't overlap.

```
471        \ifnum\@venn@intersect@n=2\relax
```

We need the point that's furthest from *C*.

```
472          \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@i@x}%
473          \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@i@y}%
474          \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
475          \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@ii@x}%
476          \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@ii@y}%
477          \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
478          \ifdim\dimen@>\dimen@i
479            \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Bx}%
480            \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@By}%
481            \edef\@venn@start@pt@x{\the\@venn@intersect@i@x}%
482            \edef\@venn@start@pt@y{\the\@venn@intersect@i@y}%
483          \else
484            \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Bx}%
485            \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@By}%
486            \edef\@venn@start@pt@x{\the\@venn@intersect@ii@x}%
487            \edef\@venn@start@pt@y{\the\@venn@intersect@ii@y}%
488          \fi
```

Compute the initial angle of the first arc.

```
489          \ifvennoldpgf
490            \pgfmathatantwo{\dimen@i}{\dimen@ii}%
491          \else
492            \pgfmathatantwo{\dimen@ii}{\dimen@i}%
493          \fi
494          \let\@venn@start@i@angle\pgfmathresult
```

Compute the intersection between *B* and *C*.

```
495          \@venn@computecircleintersects{\@venn@Bx}{\@venn@By}{\@venn@Cx}{\@venn@Cy}%
```

Need the point furthest from *A*.

```
496        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@i@x}%
497        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@i@y}%
498        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
499        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@ii@x}%
500        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@ii@y}%
501        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
502        \ifdim\dimen@>\dimen@i
503          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Bx}%
504          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@By}%
505          \edef\@venn@end@pt@i@x{\the\@venn@intersect@i@x}%
506          \edef\@venn@end@pt@i@y{\the\@venn@intersect@i@y}%
507        \else
508          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Bx}%
509          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@By}%
510          \edef\@venn@end@pt@i@x{\the\@venn@intersect@ii@x}%
511          \edef\@venn@end@pt@i@y{\the\@venn@intersect@ii@y}%
512        \fi
```

Compute the end angle of the first arc.

```
513        \ifvennoldpgf
514          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
515        \else
516          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
517        \fi
518        \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle of the second arc.

```
519        \pgfmathsetlength{\dimen@i}{\@venn@end@pt@i@x-\@venn@Cx}%
520        \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@i@y-\@venn@Cy}%
521        \ifvennoldpgf
522          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
523        \else
524          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
525        \fi
526        \let\@venn@start@ii@angle\pgfmathresult
```

Compute the intersection between *A* and *C*.

```
527        \@venn@computecircleintersects{\@venn@Ax}{\@venn@Ay}{\@venn@Cx}{\@venn@Cy}%
```

Need the point closest to *A*.

```
528        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@i@x}%
529        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@i@y}%
530        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
531        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@ii@x}%
532        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@ii@y}%
533        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
534        \ifdim\dimen@<\dimen@i
535          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%
536          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%
537          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@i@x}%
538          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@i@y}%
```

```
539        \else
540          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%
541          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%
542          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@ii@x}%
543          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@ii@y}%
544        \fi
```

Compute the end angle of the second arc.

```
545        \ifvennoldpgf
546          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
547        \else
548          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
549        \fi
550        \let\@venn@end@ii@angle\pgfmathresult
```

Compute the start angle of the third arc.

```
551        \pgfmathsetlength{\dimen@i}{\@venn@end@pt@ii@x-\@venn@Ax}%
552        \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@ii@y-\@venn@Ay}%
553        \ifvennoldpgf
554          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
555        \else
556          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
557        \fi
558        \let\@venn@start@iii@angle\pgfmathresult
```

Compute the end angle of the third arc.

```
559        \pgfmathsetlength{\dimen@i}{\@venn@start@pt@x-\@venn@Ax}%
560        \pgfmathsetlength{\dimen@ii}{\@venn@start@pt@y-\@venn@Ay}%
561        \ifvennoldpgf
562          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
563        \else
564          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
565        \fi
566        \let\@venn@end@iii@angle\pgfmathresult
```

Fill path

```
567        \path[fill=\@venn@shade]
568        (\@venn@start@pt@x,\@venn@start@pt@y)
569        arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
570        end angle=\@venn@end@i@angle]
571        arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
572        end angle=\@venn@end@ii@angle]
573        arc[radius=\@venn@radius,start angle=\@venn@start@iii@angle,
574        end angle=\@venn@end@iii@angle] -- cycle;
575      \else
576        \fillOnlyB
577      \fi
578 }%
```

OnlyC@threesets   \fillOnlyC is set to this for the three set version. Reimplemented in v1.1 to use new circle
                   intersect code.

579 `\newcommand*\@venn@fillOnlyC@threesets{%`

Get the intersection points between C and B.

580 `    \@venn@computecircleintersects{\@venn@Cx}{\@venn@Cy}{\@venn@Bx}{\@venn@By}%`

If there aren't two points of intersection, then the circles don't overlap.

581 `    \ifnum\@venn@intersect@n=2\relax`

We need the point that's furthest from A.

582 `        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@i@x}%`
583 `        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@i@y}%`
584 `        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%`
585 `        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@ii@x}%`
586 `        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@ii@y}%`
587 `        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%`
588 `        \ifdim\dimen@>\dimen@i`
589 `          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%`
590 `          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%`
591 `          \edef\@venn@start@pt@x{\the\@venn@intersect@i@x}%`
592 `          \edef\@venn@start@pt@y{\the\@venn@intersect@i@y}%`
593 `        \else`
594 `          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%`
595 `          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%`
596 `          \edef\@venn@start@pt@x{\the\@venn@intersect@ii@x}%`
597 `          \edef\@venn@start@pt@y{\the\@venn@intersect@ii@y}%`
598 `        \fi`

Compute the initial angle of the first arc.

599 `        \ifvennoldpgf`
600 `          \pgfmathatantwo{\dimen@i}{\dimen@ii}%`
601 `        \else`
602 `          \pgfmathatantwo{\dimen@ii}{\dimen@i}%`
603 `        \fi`
604 `        \let\@venn@start@i@angle\pgfmathresult`

Compute the intersection between C and A.

605 `        \@venn@computecircleintersects{\@venn@Cx}{\@venn@Cy}{\@venn@Ax}{\@venn@Ay}%`

Need the point furthest from B.

606 `        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@i@x}%`
607 `        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@i@y}%`
608 `        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%`
609 `        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@ii@x}%`
610 `        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@ii@y}%`
611 `        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%`
612 `        \ifdim\dimen@>\dimen@i`
613 `          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%`
614 `          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%`
615 `          \edef\@venn@end@pt@i@x{\the\@venn@intersect@i@x}%`
616 `          \edef\@venn@end@pt@i@y{\the\@venn@intersect@i@y}%`
617 `        \else`
618 `          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%`

```
619        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%
620        \edef\@venn@end@pt@i@x{\the\@venn@intersect@ii@x}%
621        \edef\@venn@end@pt@i@y{\the\@venn@intersect@ii@y}%
622      \fi
```

Compute the end angle of the first arc.

```
623      \ifvennoldpgf
624        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
625      \else
626        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
627      \fi
628      \let\@venn@end@i@angle\pgfmathresult
629      \pgfmathsubtract{\@venn@end@i@angle}{360}%
630      \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle of the second arc.

```
631      \pgfmathsetlength{\dimen@i}{\@venn@end@pt@i@x-\@venn@Ax}%
632      \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@i@y-\@venn@Ay}%
633      \ifvennoldpgf
634        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
635      \else
636        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
637      \fi
638      \let\@venn@start@ii@angle\pgfmathresult
```

Compute the intersection between *B* and *A*.

```
639      \@venn@computecircleintersects{\@venn@Bx}{\@venn@By}{\@venn@Ax}{\@venn@Ay}%
```

Need the point closest to *C*.

```
640      \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@i@x}%
641      \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@i@y}%
642      \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
643      \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@ii@x}%
644      \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@ii@y}%
645      \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
646      \ifdim\dimen@<\dimen@i
647        \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
648        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
649        \edef\@venn@end@pt@ii@x{\the\@venn@intersect@i@x}%
650        \edef\@venn@end@pt@ii@y{\the\@venn@intersect@i@y}%
651      \else
652        \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
653        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
654        \edef\@venn@end@pt@ii@x{\the\@venn@intersect@ii@x}%
655        \edef\@venn@end@pt@ii@y{\the\@venn@intersect@ii@y}%
656      \fi
```

Compute the end angle of the second arc.

```
657      \ifvennoldpgf
658        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
659      \else
```

```
660        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
661      \fi
662      \let\@venn@end@ii@angle\pgfmathresult
```

Compute the start angle of the third arc.

```
663      \pgfmathsetlength{\dimen@i}{\@venn@end@pt@ii@x-\@venn@Bx}%
664      \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@ii@y-\@venn@By}%
665      \ifvennoldpgf
666        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
667      \else
668        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
669      \fi
670      \let\@venn@start@iii@angle\pgfmathresult
```

Compute the end angle of the third arc.

```
671      \pgfmathsetlength{\dimen@i}{\@venn@start@pt@x-\@venn@Bx}%
672      \pgfmathsetlength{\dimen@ii}{\@venn@start@pt@y-\@venn@By}%
673      \ifvennoldpgf
674        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
675      \else
676        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
677      \fi
678      \let\@venn@end@iii@angle\pgfmathresult
```

Fill path

```
679      \path[fill=\@venn@shade] (\@venn@start@pt@x,\@venn@start@pt@y)
680      arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
681      end angle=\@venn@end@i@angle]
682      arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
683      end angle=\@venn@end@ii@angle]
684      arc[radius=\@venn@radius,start angle=\@venn@start@iii@angle,
685      end angle=\@venn@end@iii@angle] -- cycle;
686    \else
687      \fillOnlyC
688    \fi
689 }%
```

\fillNotABC is set to this for the three set version. Reimplemented in v1.1 to use new circle intersect code.

```
690 \newcommand*\@venn@fillNotABC@threesets{%
```

Get the intersection points between *A* and *B*.

```
691      \@venn@computecircleintersects{\@venn@Ax}{\@venn@Ay}{\@venn@Bx}{\@venn@By}%
```

If there aren't two points of intersection, then the circles don't overlap.

```
692      \ifnum\@venn@intersect@n=2\relax
```

We need the point that's furthest from *C*.

```
693        \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@i@x}%
694        \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@i@y}%
695        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
```

```
696        \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@ii@x}%
697        \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@ii@y}%
698        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
699        \ifdim\dimen@>\dimen@i
700          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
701          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
702          \edef\@venn@start@pt@x{\the\@venn@intersect@i@x}%
703          \edef\@venn@start@pt@y{\the\@venn@intersect@i@y}%
704        \else
705          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
706          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
707          \edef\@venn@start@pt@x{\the\@venn@intersect@ii@x}%
708          \edef\@venn@start@pt@y{\the\@venn@intersect@ii@y}%
709        \fi
```

Compute the initial angle of the first arc.

```
710        \ifvennoldpgf
711          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
712        \else
713          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
714        \fi
715        \let\@venn@start@i@angle\pgfmathresult
```

Compute the intersection between *A* and *C*.

```
716        \@venn@computecircleintersects{\@venn@Ax}{\@venn@Ay}{\@venn@Cx}{\@venn@Cy}%
```

We need the point that's furthest from *B*.

```
717        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@i@x}%
718        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@i@y}%
719        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
720        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@ii@x}%
721        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@ii@y}%
722        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
723        \ifdim\dimen@>\dimen@i
724          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
725          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
726          \edef\@venn@end@pt@i@x{\the\@venn@intersect@i@x}%
727          \edef\@venn@end@pt@i@y{\the\@venn@intersect@i@y}%
728        \else
729          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
730          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
731          \edef\@venn@end@pt@i@x{\the\@venn@intersect@ii@x}%
732          \edef\@venn@end@pt@i@y{\the\@venn@intersect@ii@y}%
733        \fi
```

Compute the end angle of the first arc.

```
734        \ifvennoldpgf
735          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
736        \else
737          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
738        \fi
```

```
739        \let\@venn@end@i@angle\pgfmathresult
740        \pgfmathadd{\@venn@end@i@angle}{360}%
741        \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle of the second arc.

```
742        \pgfmathsetlength{\dimen@i}{\@venn@end@pt@i@x-\@venn@Cx}%
743        \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@i@y-\@venn@Cy}%
744        \ifvennoldpgf
745          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
746        \else
747          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
748        \fi
749        \let\@venn@start@ii@angle\pgfmathresult
```

Compute the intersection between *C* and *B*.

```
750        \@venn@computecircleintersects{\@venn@Cx}{\@venn@Cy}{\@venn@Bx}{\@venn@By}%
```

We need the point that's furthest from *A*.

```
751        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@i@x}%
752        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@i@y}%
753        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
754        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@ii@x}%
755        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@ii@y}%
756        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
757        \ifdim\dimen@>\dimen@i
758          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%
759          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%
760          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@i@x}%
761          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@i@y}%
762        \else
763          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%
764          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%
765          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@ii@x}%
766          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@ii@y}%
767        \fi
```

Compute the end angle of the second arc.

```
768        \ifvennoldpgf
769          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
770        \else
771          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
772        \fi
773        \let\@venn@end@ii@angle\pgfmathresult
774        \pgfmathadd{\@venn@end@ii@angle}{360}%
775        \let\@venn@end@ii@angle\pgfmathresult
```

Compute the start angle of the third arc.

```
776        \pgfmathsetlength{\dimen@i}{\@venn@end@pt@ii@x-\@venn@Bx}%
777        \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@ii@y-\@venn@By}%
778        \ifvennoldpgf
779          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
```

```
780        \else
781          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
782        \fi
783        \let\@venn@start@iii@angle\pgfmathresult
```

Compute the end angle of the third arc.

```
784        \pgfmathsetlength{\dimen@i}{\@venn@start@pt@x-\@venn@Bx}%
785        \pgfmathsetlength{\dimen@ii}{\@venn@start@pt@y-\@venn@By}%
786        \ifvennoldpgf
787          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
788        \else
789          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
790        \fi
791        \let\@venn@end@iii@angle\pgfmathresult
```

Fill path

```
792        \path[fill=\@venn@shade,even odd rule]
793          (0,0) rectangle (\@venn@w,\@venn@h)
794          (\@venn@start@pt@x,\@venn@start@pt@y)
795          arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
796          end angle=\@venn@end@i@angle]
797          arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
798          end angle=\@venn@end@ii@angle]
799          arc[radius=\@venn@radius,start angle=\@venn@start@iii@angle,
800          end angle=\@venn@end@iii@angle]
801          -- cycle;
802        \else
803          \path[fill=\@venn@shade,even odd rule]
804          (0,0) rectangle (\@venn@w,\@venn@h)
805          (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
806          (\@venn@Bx,\@venn@By) circle (\@venn@radius)
807          (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);%
808        \fi
809 }%
```

```
810 \newenvironment{venndiagram2sets}[1][]%
811 {%
```

Disable the keys that aren't applicable.

```
812   \disable@keys{venn}{labelABC,labelOnlyC,labelOnlyAC,labelOnlyBC,%
813     labelNotABC,labelC,labelOnlyAB}%
```

Set the key values given in the optional argument.

```
814   \setkeys{venn}{#1}%
```

Calculate centre of A

```
815   \pgfmathsetlength{\@venn@Ax}{\@venn@hgap+\@venn@radius}%
816   \pgfmathsetlength{\@venn@Ay}{\@venn@vgap+\@venn@radius}%
```

Calculate centre of B

```
817   \pgfmathsetlength{\@venn@Bx}{\@venn@hgap+3*\@venn@radius
```

```
818     -\@venn@overlap}%
819  \setlength{\@venn@By}{\@venn@Ay}%
```

Compute dimensions of entire diagram

```
820  \pgfmathsetlength{\@venn@w}{2*\@venn@hgap+4*\@venn@radius
821     -\@venn@overlap}%
822  \pgfmathsetlength{\@venn@h}{2*\@venn@vgap+2*\@venn@radius}%
```

Define filling commands

```
823  \def\fillA{\path[fill=\@venn@shade] (\@venn@Ax,\@venn@Ay)
824     circle (\@venn@radius);}%
825  \def\fillB{\path[fill=\@venn@shade] (\@venn@Bx,\@venn@By)
826     circle (\@venn@radius);}%
827  \def\fillAll{\path[fill=\@venn@shade] (0,0)
828     rectangle (\@venn@w,\@venn@h);}%
```

Fill only set A

```
829  \let\fillOnlyA\@venn@fillOnlyA@twosets
```

Fill only set B

```
830  \let\fillOnlyB\@venn@fillOnlyB@twosets
```

Fill everything except A

```
831  \def\fillNotA{\path[fill=\@venn@shade,even odd rule]
832     (0,0) rectangle (\@venn@w,\@venn@h)
833     (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);}%
```

Fill everything except B

```
834  \def\fillNotB{\path[fill=\@venn@shade,even odd rule]
835     (0,0) rectangle (\@venn@w,\@venn@h)
836     (\@venn@Bx,\@venn@By) circle (\@venn@radius);}%
```

Fill everything except A or B $((A \cup B)^c)$

```
837  \def\fillNotAorB{%
838     \begin{scope}
839     \path[clip]
840     (0,0) rectangle (\@venn@w,\@venn@h)
841     (\@venn@Bx,\@venn@By) circle (\@venn@radius)
842      ;
843     \path[fill=\@venn@shade,even odd rule]
844     (0,0) rectangle (\@venn@w,\@venn@h)
845     (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
846     ;
847     \end{scope}
848     }%
```

Fill not A or not B $((A \cap B)^c)$

```
849  \def\fillNotAorNotB{%
850     \path[fill=\@venn@shade,nonzero rule]
851     (0,0) rectangle (\@venn@w,\@venn@h)
852     (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
853     (0,0) rectangle (\@venn@w,\@venn@h)
```

```
854        (\@venn@Bx,\@venn@By) circle (\@venn@radius)
855        ;
856    }%
```

Fill *A* but not *B* (same as only *A* for two sets).

```
857    \let\fillANotB\fillOnlyA
```

Fill *B* but not *A* (same as only *B* for two sets).

```
858    \let\fillBNotA\fillOnlyB
```

Fill *A* intersect *B*

```
859    \def\fillACapB{%
860      \begin{scope}
861        \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
862        \path[fill=\@venn@shade]
863          (\@venn@Bx,\@venn@By) circle (\@venn@radius);
864      \end{scope}
865    }%
```

Define synonym:

```
866    \let\fillBCapA\fillACapB
```

Start the tikzpicture environment.

```
867    \ifdefempty{\@venn@tikzoptions}%
868    {%
869      \def\@venn@dobegin{\begin{tikzpicture}}%
870    }%
871    {%
872      \edef\@venn@dobegin{\noexpand\begin{tikzpicture}%
873        [\expandonce\@venn@tikzoptions]}%
874    }%
875    \@venn@dobegin
```

coordinates of the Venn diagram corners

```
876    \path (0,0) coordinate (venn bottom left)
877         (0,\@venn@h) coordinate (venn top left)
878         (\@venn@w,\@venn@h) coordinate (venn top right)
879         (\@venn@w,0) coordinate (venn bottom right);
880 }%
```

End environment code

```
881 {%
```

Draw outlines

```
882    \draw (venn bottom left) rectangle (\@venn@w,\@venn@h);
883    \draw (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
884    \draw (\@venn@Bx,\@venn@By) circle (\@venn@radius);
```

Draw labels

```
885    \draw (\@venn@Ax,\@venn@Ay) node[above,left] (labelOnlyA)
886        {\@venn@label@OnlyA};
887    \draw (\@venn@Bx,\@venn@By) node[above,right] (labelOnlyB)
888        {\@venn@label@OnlyB};
```

Region labels

```
889      \draw (\@venn@vgap,\@venn@hgap) node (labelNotAB) {\@venn@label@NotAB};
890      \draw (\@venn@Ax,\@venn@Ay+\@venn@radius)
891        node[below] (labelA) {\@venn@label@A};
892      \draw (\@venn@Bx,\@venn@By+\@venn@radius)
893        node[below] (labelB) {\@venn@label@B};
894      \draw (0.5*\@venn@w,0.5*\@venn@h) node (labelAB) {\@venn@label@AB};
895      \@postvennhook
896   \end{tikzpicture}
897 }
```

\fillOnlyA is set to this for the two set version. Reimplemented in v1.1 to use new circle intersect code.

```
898 \newcommand*\@venn@fillOnlyA@twosets{%
```

Get the intersection points between *A* and *B*.

```
899      \@venn@computecircleintersects{\@venn@Ax}{\@venn@Ay}{\@venn@Bx}{\@venn@By}%
```

If there aren't two points of intersection, then the circles don't overlap.

```
900      \ifnum\@venn@intersect@n=2\relax
```

Compute the start angle for the first arc.

```
901        \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
902        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
903        \ifvennoldpgf
904          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
905        \else
906          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
907        \fi
908        \let\@venn@start@i@angle\pgfmathresult
```

Compute the end angle for the first arc.

```
909        \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
910        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
911        \ifvennoldpgf
912          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
913        \else
914          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
915        \fi
916        \let\@venn@end@i@angle\pgfmathresult
917        \pgfmathadd{\@venn@end@i@angle}{360}%
918        \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle for the second arc.

```
919        \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Bx}%
920        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@By}%
921        \ifvennoldpgf
922          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
923        \else
924          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
925        \fi
```

926   \let\@venn@start@ii@angle\pgfmathresult

Compute the end angle for the second arc.

927   \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Bx}%
928   \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@By}%
929   \ifvennoldpgf
930   \pgfmathatantwo{\dimen@i}{\dimen@ii}%
931   \else
932   \pgfmathatantwo{\dimen@ii}{\dimen@i}%
933   \fi
934   \let\@venn@end@ii@angle\pgfmathresult
935   \pgfmathadd{\@venn@start@ii@angle}{360}%
936   \let\@venn@start@ii@angle\pgfmathresult

 Fill the path

937   \path[fill=\@venn@shade]
938   (\@venn@intersect@i@x,\@venn@intersect@i@y)
939   arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
940   end angle=\@venn@end@i@angle]
941   arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
942   end angle=\@venn@end@ii@angle]
943   -- cycle;
944   \else
945   \fillOnlyA
946   \fi
947 }%

llOnlyB@twosets \fillOnlyB is set to this for the two set version. Reimplemented in v1.1 to use new circle
                 intersect code.

948 \newcommand*\@venn@fillOnlyB@twosets{%

Get the intersection points between *A* and *B*.

949   \@venn@computecircleintersects{\@venn@Ax}{\@venn@Ay}{\@venn@Bx}{\@venn@By}%

If there aren't two points of intersection, then the circles don't overlap.

950   \ifnum\@venn@intersect@n=2\relax

Compute the start angle for the first arc.

951   \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Bx}%
952   \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@By}%
953   \ifvennoldpgf
954   \pgfmathatantwo{\dimen@i}{\dimen@ii}%
955   \else
956   \pgfmathatantwo{\dimen@ii}{\dimen@i}%
957   \fi
958   \let\@venn@start@i@angle\pgfmathresult

Compute the end angle for the first arc.

959   \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Bx}%
960   \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@By}%
961   \ifvennoldpgf

```
962        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
963      \else
964        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
965      \fi
966      \let\@venn@end@i@angle\pgfmathresult
967 %      \pgfmathadd{\@venn@end@i@angle}{360}%
968 %      \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle for the second arc.

```
969      \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
970      \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
971      \ifvennoldpgf
972        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
973      \else
974        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
975      \fi
976      \let\@venn@start@ii@angle\pgfmathresult
```

Compute the end angle for the second arc.

```
977      \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
978      \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
979      \ifvennoldpgf
980        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
981      \else
982        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
983      \fi
984      \let\@venn@end@ii@angle\pgfmathresult
985 %      \pgfmathadd{\@venn@start@ii@angle}{360}%
986 %      \let\@venn@start@ii@angle\pgfmathresult
```

Fill the path

```
987      \path[fill=\@venn@shade]
988        (\@venn@intersect@i@x,\@venn@intersect@i@y)
989      arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
990      end angle=\@venn@end@i@angle]
991      arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
992      end angle=\@venn@end@ii@angle]
993        -- cycle;
994    \else
995      \fillOnlyB
996    \fi
997 }%
```

Index

Numbers written in italic refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in roman refer to the code lines where the entry is used.