venndiagram v1.2: 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

> `\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.)

showframe This is a boolean option (default: `true`). If `true`, the surrounding rectangular frame is drawn. If `false`, the frame isn't drawn but still contributes to the total image size as a hidden path. If the value is omitted `true` is assumed.

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`
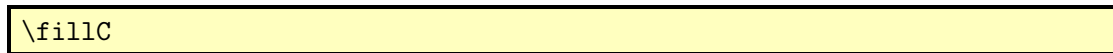
```
\fillA
```

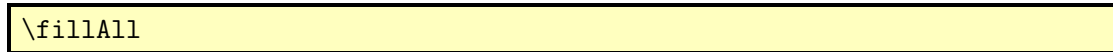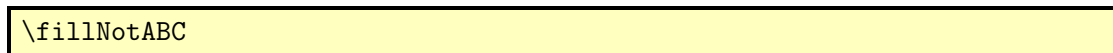Shades set A.

`\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}
```
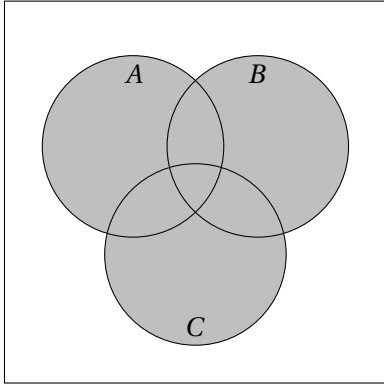
Produces:

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

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

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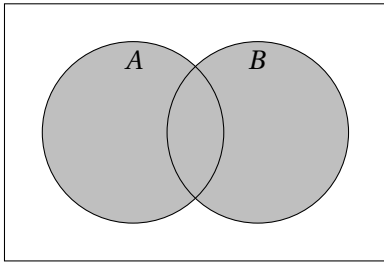
3. (Three sets) $A \setminus (B \cup C)$

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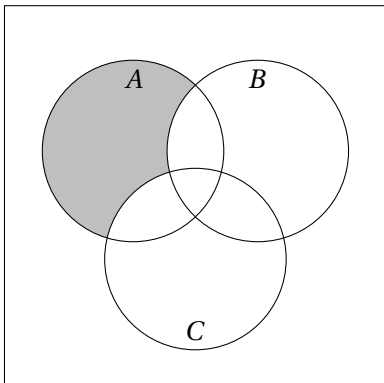
Produces:

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

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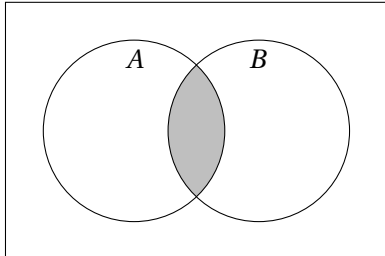

5. (Three sets) region labels:

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

Produces:
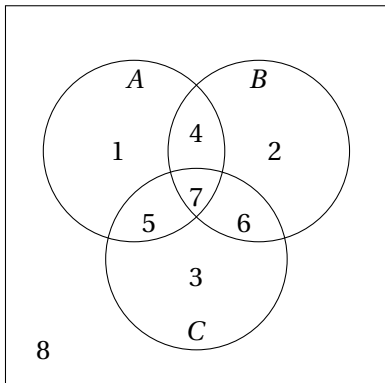
6. Annotating the diagram:

```
\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:
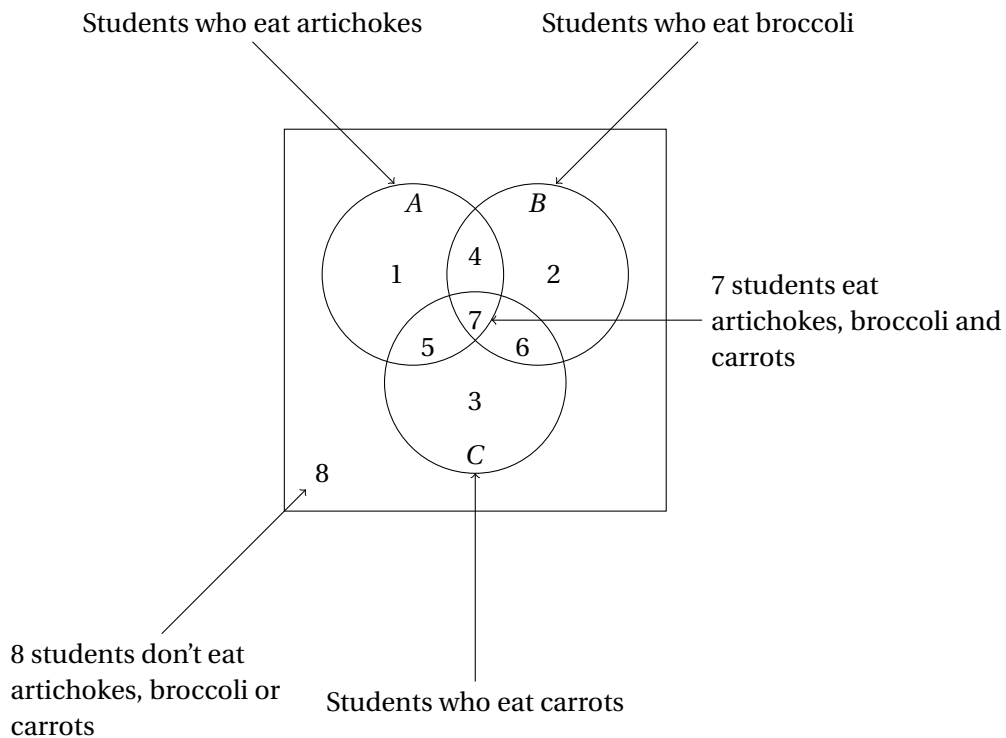
3 The Code

Package identification:

```
1 \NeedsTeXFormat{LaTeX2e}
2 \ProvidesPackage{venndiagram}[2018/06/07 v1.2 (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`

11

\@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}}`

showframe Draw the frame outline.

63 `\define@boolkey{venn}[venn]{showframe}[true]{}`
64 `\vennshowframetrue`

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

tikzoptions

65 `\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:

$$(x - a_x)^2 - (x - b_x)^2 + (y - a_y)^2 - (y - b_y)^2 = 0 \tag{3}$$

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):

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

14

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.

66 \newcommand*{\@venn@computecircleintersects}[4]{%
67 \ifdim#1=#3\relax

15

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

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

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

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

One point of intersection.

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

Two points of intersection.

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

No intersection.

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

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

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

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

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

One point of intersection.

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

Two points of intersection.

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

```
103        \addtolength{\@venn@intersect@ii@y}{-\dimen@i}%
104      \else
```

No intersection.

```
105        \def\@venn@intersect@n{0}%
106      \fi
107    \fi
108  \else
```

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

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

Set

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

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

Set

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

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

Compute $(1 + m^2)$.

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

Compute

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

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

Denote this value b and now compute

$$b^2 - (1 + m^2)(a_x^2 + a_y^2 + c^2 - 2a_y c - r^2)$$

```
128    \pgfmathparse{\@vnn@b*\@vnn@b
129      - \@vnn@one@plus@m@sq
130      *(\@vnn@ax@sq+\@vnn@ay@sq+\@vnn@c*\@vnn@c
```

17

```
131          -2*\@vnn@ay*\@vnn@c-\@vnn@r@sq)}%
132      \let\@vnn@root\pgfmathresult
133      \setlength\dimen@{\pgfmathresult in}%
134      \ifdim\dimen@=0pt\relax
```

One point of intersection.

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

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

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

$$y_1 = mx_1 + c$$

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

Two points of intersection.

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

First point.

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

Second point.

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

No intersection.

```
156          \def\@venn@intersect@n{0}%
157        \fi
158      \fi
159    \fi
160  \fi
161 }
```

n@intersect@i@x

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

n@intersect@i@y

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

@intersect@ii@x

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

@intersect@ii@y

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

3.4 Environment Definitions

enndiagram3sets   Environment to draw Venn diagram with three sets.

```
166 \newenvironment{venndiagram3sets}[1][]%
167 {%
```

Disable the keys that aren't applicable.

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

Set the key values given in the optional argument.

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

Calculate centre of set *C*

```
170   \pgfmathsetlength{\@venn@Cx}{\@venn@hgap + 2*\@venn@radius
171     -0.5*\@venn@overlap}%
172   \pgfmathsetlength{\@venn@Cy}{\@venn@vgap+\@venn@radius}%
```

Calculate centre of set *A*

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

Calculate centre of set *B*

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

Compute dimensions of entire diagram

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

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

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

Fill all of set *B*:

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

Fill all of set *C*:

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

Fill everything:

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

Fill everything except set *A*:

```
191  \def\fillNotA{\path[fill=\@venn@shade,even odd rule]
192    (0,0) rectangle (\@venn@w,\@venn@h)
193    (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);}%
```

Fill everything except set *B*:

```
194  \def\fillNotB{\path[fill=\@venn@shade,even odd rule]
195    (0,0) rectangle (\@venn@w,\@venn@h)
196    (\@venn@Bx,\@venn@By) circle (\@venn@radius);}%
```

Fill everything except set *C*:

```
197  \def\fillNotC{\path[fill=\@venn@shade,even odd rule]
198    (0,0) rectangle (\@venn@w,\@venn@h)
199    (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);}%
```

Fill only set *A*.

```
200  \let\fillOnlyA\@venn@fillOnlyA@threesets
```

Fill only set *B*:

```
201  \let\fillOnlyB\@venn@fillOnlyB@threesets
```

Fill only set *C*:

```
202  \let\fillOnlyC\@venn@fillOnlyC@threesets
```

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

```
203  \let\fillNotABC\@venn@fillNotABC@threesets
```

Fill *A* but not *B*

```
204  \def\fillANotB{%
205    \begin{scope}
206      \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
207      \path[fill=\@venn@shade,even odd rule]
208        (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
209        (\@venn@Bx,\@venn@By) circle (\@venn@radius);
210    \end{scope}
211  }%
```

Fill *B* but not *A*

```
212  \def\fillBNotA{%
213    \begin{scope}
214      \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
215      \path[fill=\@venn@shade,even odd rule]
216        (\@venn@Bx,\@venn@By) circle (\@venn@radius)
217        (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
218    \end{scope}
219  }%
```

Fill *A* but not *C*

```
220  \def\fillANotC{%
```

```
221       \begin{scope}
222         \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
223         \path[fill=\@venn@shade,even odd rule]
224           (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
225           (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
226       \end{scope}
227     }%
```

Fill *C* but not *A*

```
228   \def\fillCNotA{%
229       \begin{scope}
230         \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
231         \path[fill=\@venn@shade,even odd rule]
232           (\@venn@Cx,\@venn@Cy) circle (\@venn@radius)
233           (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
234       \end{scope}
235     }%
```

Fill *B* but not *C*

```
236   \def\fillBNotC{%
237       \begin{scope}
238         \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
239         \path[fill=\@venn@shade,even odd rule]
240           (\@venn@Bx,\@venn@By) circle (\@venn@radius)
241           (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
242       \end{scope}
243     }%
```

Fill *C* but not *B*

```
244   \def\fillCNotB{%
245       \begin{scope}
246         \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
247         \path[fill=\@venn@shade,even odd rule]
248           (\@venn@Cx,\@venn@Cy) circle (\@venn@radius)
249           (\@venn@Bx,\@venn@By) circle (\@venn@radius);
250       \end{scope}
251     }%
```

Fill *A* intersect *B*

```
252   \def\fillACapB{%
253       \begin{scope}
254         \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
255         \path[fill=\@venn@shade]
256           (\@venn@Bx,\@venn@By) circle (\@venn@radius);
257       \end{scope}
258     }%
```

Define a synonym:

```
259   \let\fillBCapA\fillACapB
```

Fill *A* intersect *C*

```
260   \def\fillACapC{%
```

```
261      \begin{scope}
262        \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
263        \path[fill=\@venn@shade]
264          (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
265      \end{scope}
266    }%
```

Define a synonym:

```
267    \let\fillCCapA\fillACapC
```

Fill *B* intersect *C*

```
268    \def\fillBCapC{%
269      \begin{scope}
270        \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
271        \path[fill=\@venn@shade]
272          (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
273      \end{scope}
274    }%
```

Define a synonym:

```
275    \let\fillCCapB\fillBCapC
```

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

```
276    \def\fillACapBNotC{%
277      \begin{scope}
278        \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
279        \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
280        \path[fill=\@venn@shade,even odd rule]
281          (\@venn@Bx,\@venn@By) circle (\@venn@radius)
282          (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
283      \end{scope}
284    }%
```

Define a synonym:

```
285    \let\fillBCapANotC\fillACapBNotC
```

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

```
286    \def\fillACapCNotB{%
287      \begin{scope}
288        \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
289        \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
290        \path[fill=\@venn@shade,even odd rule]
291          (\@venn@Cx,\@venn@Cy) circle (\@venn@radius)
292          (\@venn@Bx,\@venn@By) circle (\@venn@radius);
293      \end{scope}
294    }%
```

Define a synonym:

```
295    \let\fillCCapANotB\fillACapCNotB
```

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

```
296    \def\fillBCapCNotA{%
```

```
297      \begin{scope}
298        \clip (\@venn@Bx,\@venn@By) circle (\@venn@radius);
299        \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
300        \path[fill=\@venn@shade,even odd rule]
301          (\@venn@Cx,\@venn@Cy) circle (\@venn@radius)
302          (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
303      \end{scope}
304    }%
```

Define a synonym:

```
305    \let\fillCCapBNotA\fillBCapCNotA
```

Fill the intersection of all three sets

```
306    \def\fillACapBCapC{%
307      \begin{scope}
308        \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
309        \clip (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
310        \path[fill=\@venn@shade]
311          (\@venn@Bx,\@venn@By) circle (\@venn@radius);
312      \end{scope}
313    }%
```

Define synonyms:

```
314    \let\fillACapCCapB\fillACapBCapC
315    \let\fillBCapACapC\fillACapBCapC
316    \let\fillBCapCCapA\fillACapBCapC
317    \let\fillCCapACapB\fillACapBCapC
318    \let\fillCCapBCapA\fillACapBCapC
```

Start the tikzpicture environment.

```
319    \ifdefempty{\@venn@tikzoptions}%
320    {%
321      \def\@venn@dobegin{\begin{tikzpicture}}%
322    }%
323    {%
324      \edef\@venn@dobegin{\noexpand\begin{tikzpicture}%
325        [\expandonce\@venn@tikzoptions]}%
326    }%
327    \@venn@dobegin
```

coordinates of the Venn diagram corners

```
328    \path (0,0) coordinate (venn bottom left)
329        (0,\@venn@h) coordinate (venn top left)
330        (\@venn@w,\@venn@h) coordinate (venn top right)
331        (\@venn@w,0) coordinate (venn bottom right);
332 }%
```

End environment code:

```
333 {%
```

Draw outlines

```
334      \ifvennshowframe
```

```
335        \draw (0,0) rectangle (\@venn@w,\@venn@h);
336      \else
337        \path (0,0) rectangle (\@venn@w,\@venn@h);
338      \fi
339      \draw (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
340      \draw (\@venn@Bx,\@venn@By) circle (\@venn@radius);
341      \draw (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);
```

Draw labels

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

Region labels

```
345      \draw (\@venn@vgap,\@venn@hgap) node (labelNotABC) {\@venn@label@NotABC};
346      \draw (\@venn@Ax,\@venn@Ay+\@venn@radius)
347        node[below] (labelA) {\@venn@label@A};
348      \draw (\@venn@Bx,\@venn@By+\@venn@radius)
349        node[below] (labelB) {\@venn@label@B};
350      \draw (\@venn@Cx,\@venn@vgap) node[above] (labelC) {\@venn@label@C};
351      \draw (\@venn@Cx,0.5*\@venn@h) node (labelABC) {\@venn@label@ABC};
352      \draw (\@venn@Cx,\@venn@Ay) node[above] (labelOnlyAB) {\@venn@label@OnlyAB};
353      \draw (\@venn@Ax,\@venn@Ay) ++(-60:\@venn@radius-0.5*\@venn@overlap)
354        node[below left] (labelOnlyAC) {\@venn@label@OnlyAC};
355      \draw (\@venn@Bx,\@venn@By) ++(-120:\@venn@radius-0.5*\@venn@overlap)
356        node[below right] (labelOnlyBC) {\@venn@label@OnlyBC};
357      \@postvennhook
358    \end{tikzpicture}
359 }
```

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

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

setpostvennhook   User interface to set the post hook.

```
361 \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.

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

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

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

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

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

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

```
365        \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@i@x}%
366        \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@i@y}%
367        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
368        \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@ii@x}%
```

```
369        \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@ii@y}%
370        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
371        \ifdim\dimen@>\dimen@i
372          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
373          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
374          \edef\@venn@start@pt@x{\the\@venn@intersect@i@x}%
375          \edef\@venn@start@pt@y{\the\@venn@intersect@i@y}%
376        \else
377          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
378          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
379          \edef\@venn@start@pt@x{\the\@venn@intersect@ii@x}%
380          \edef\@venn@start@pt@y{\the\@venn@intersect@ii@y}%
381        \fi
```

Compute the initial angle of the first arc.

```
382        \ifvennoldpgf
383          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
384        \else
385          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
386        \fi
387        \let\@venn@start@i@angle\pgfmathresult
```

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

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

Need the point furthest from *B*.

```
389        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@i@x}%
390        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@i@y}%
391        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
392        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@ii@x}%
393        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@ii@y}%
394        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
395        \ifdim\dimen@>\dimen@i
396          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
397          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
398          \edef\@venn@end@pt@i@x{\the\@venn@intersect@i@x}%
399          \edef\@venn@end@pt@i@y{\the\@venn@intersect@i@y}%
400        \else
401          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
402          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
403          \edef\@venn@end@pt@i@x{\the\@venn@intersect@ii@x}%
404          \edef\@venn@end@pt@i@y{\the\@venn@intersect@ii@y}%
405        \fi
```

Compute the end angle of the first arc.

```
406        \ifvennoldpgf
407          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
408        \else
409          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
410        \fi
411        \let\@venn@end@i@angle\pgfmathresult
```

```
412        \pgfmathadd{\@venn@end@i@angle}{360}%
413        \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle of the second arc.

```
414        \pgfmathsetlength{\dimen@i}{\@venn@end@pt@i@x-\@venn@Cx}%
415        \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@i@y-\@venn@Cy}%
416        \ifvennoldpgf
417          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
418        \else
419          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
420        \fi
421        \let\@venn@start@ii@angle\pgfmathresult
```

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

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

Need the point closest to *A*.

```
423        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@i@x}%
424        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@i@y}%
425        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
426        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@ii@x}%
427        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@ii@y}%
428        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
429        \ifdim\dimen@<\dimen@i
430          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%
431          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%
432          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@i@x}%
433          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@i@y}%
434        \else
435          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%
436          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%
437          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@ii@x}%
438          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@ii@y}%
439        \fi
```

Compute the end angle of the second arc.

```
440        \ifvennoldpgf
441          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
442        \else
443          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
444        \fi
445        \let\@venn@end@ii@angle\pgfmathresult
```

Compute the start angle of the third arc.

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

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Compute the end angle of the third arc.

```
454        \pgfmathsetlength{\dimen@i}{\@venn@start@pt@x-\@venn@Bx}%
455        \pgfmathsetlength{\dimen@ii}{\@venn@start@pt@y-\@venn@By}%
456        \ifvennoldpgf
457          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
458        \else
459          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
460        \fi
461        \let\@venn@end@iii@angle\pgfmathresult
462        \pgfmathsubtract{\@venn@end@iii@angle}{360}%
463        \let\@venn@end@iii@angle\pgfmathresult
```

Fill path

```
464        \path[fill=\@venn@shade] (\@venn@start@pt@x,\@venn@start@pt@y)
465        arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
466        end angle=\@venn@end@i@angle]
467        arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
468        end angle=\@venn@end@ii@angle]
469        arc[radius=\@venn@radius,start angle=\@venn@start@iii@angle,
470        end angle=\@venn@end@iii@angle] -- cycle;
471      \else
472        \fillOnlyA
473      \fi
474 }%
```

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

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

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

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

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

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

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

```
478          \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@i@x}%
479          \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@i@y}%
480          \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
481          \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@ii@x}%
482          \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@ii@y}%
483          \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
484          \ifdim\dimen@>\dimen@i
485            \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Bx}%
486            \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@By}%
487            \edef\@venn@start@pt@x{\the\@venn@intersect@i@x}%
488            \edef\@venn@start@pt@y{\the\@venn@intersect@i@y}%
489          \else
490            \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Bx}%
491            \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@By}%
```

```
492        \edef\@venn@start@pt@x{\the\@venn@intersect@ii@x}%
493        \edef\@venn@start@pt@y{\the\@venn@intersect@ii@y}%
494      \fi
```

Compute the initial angle of the first arc.

```
495      \ifvennoldpgf
496        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
497      \else
498        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
499      \fi
500      \let\@venn@start@i@angle\pgfmathresult
```

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

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

Need the point furthest from *A*.

```
502      \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@i@x}%
503      \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@i@y}%
504      \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
505      \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@ii@x}%
506      \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@ii@y}%
507      \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
508      \ifdim\dimen@>\dimen@i
509        \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Bx}%
510        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@By}%
511        \edef\@venn@end@pt@i@x{\the\@venn@intersect@i@x}%
512        \edef\@venn@end@pt@i@y{\the\@venn@intersect@i@y}%
513      \else
514        \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Bx}%
515        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@By}%
516        \edef\@venn@end@pt@i@x{\the\@venn@intersect@ii@x}%
517        \edef\@venn@end@pt@i@y{\the\@venn@intersect@ii@y}%
518      \fi
```

Compute the end angle of the first arc.

```
519      \ifvennoldpgf
520        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
521      \else
522        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
523      \fi
524      \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle of the second arc.

```
525      \pgfmathsetlength{\dimen@i}{\@venn@end@pt@i@x-\@venn@Cx}%
526      \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@i@y-\@venn@Cy}%
527      \ifvennoldpgf
528        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
529      \else
530        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
531      \fi
532      \let\@venn@start@ii@angle\pgfmathresult
```

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

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

Need the point closest to *A*.

```
534        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@i@x}%
535        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@i@y}%
536        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
537        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@ii@x}%
538        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@ii@y}%
539        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
540        \ifdim\dimen@<\dimen@i
541          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%
542          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%
543          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@i@x}%
544          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@i@y}%
545        \else
546          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%
547          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%
548          \edef\@venn@end@pt@ii@x{\the\@venn@intersect@ii@x}%
549          \edef\@venn@end@pt@ii@y{\the\@venn@intersect@ii@y}%
550        \fi
```

Compute the end angle of the second arc.

```
551        \ifvennoldpgf
552          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
553        \else
554          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
555        \fi
556        \let\@venn@end@ii@angle\pgfmathresult
```

Compute the start angle of the third arc.

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

Compute the end angle of the third arc.

```
565        \pgfmathsetlength{\dimen@i}{\@venn@start@pt@x-\@venn@Ax}%
566        \pgfmathsetlength{\dimen@ii}{\@venn@start@pt@y-\@venn@Ay}%
567        \ifvennoldpgf
568          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
569        \else
570          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
571        \fi
572        \let\@venn@end@iii@angle\pgfmathresult
```

Fill path

```
573        \path[fill=\@venn@shade]
574        (\@venn@start@pt@x,\@venn@start@pt@y)
575        arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
576        end angle=\@venn@end@i@angle]
577        arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
578        end angle=\@venn@end@ii@angle]
579        arc[radius=\@venn@radius,start angle=\@venn@start@iii@angle,
580        end angle=\@venn@end@iii@angle] -- cycle;
581      \else
582        \fillOnlyB
583      \fi
584 }%
```

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

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

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

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

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

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

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

```
588        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@i@x}%
589        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@i@y}%
590        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
591        \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@ii@x}%
592        \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@ii@y}%
593        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
594        \ifdim\dimen@>\dimen@i
595          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%
596          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%
597          \edef\@venn@start@pt@x{\the\@venn@intersect@i@x}%
598          \edef\@venn@start@pt@y{\the\@venn@intersect@i@y}%
599        \else
600          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%
601          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%
602          \edef\@venn@start@pt@x{\the\@venn@intersect@ii@x}%
603          \edef\@venn@start@pt@y{\the\@venn@intersect@ii@y}%
604        \fi
```

Compute the initial angle of the first arc.

```
605        \ifvennoldpgf
606          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
607        \else
608          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
609        \fi
610        \let\@venn@start@i@angle\pgfmathresult
```

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

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

Need the point furthest from *B*.

```
612        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@i@x}%
613        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@i@y}%
614        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
615        \pgfmathsetlength{\dimen@i}{\@venn@Bx-\@venn@intersect@ii@x}%
616        \pgfmathsetlength{\dimen@ii}{\@venn@By-\@venn@intersect@ii@y}%
617        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
618        \ifdim\dimen@>\dimen@i
619          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%
620          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%
621          \edef\@venn@end@pt@i@x{\the\@venn@intersect@i@x}%
622          \edef\@venn@end@pt@i@y{\the\@venn@intersect@i@y}%
623        \else
624          \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%
625          \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%
626          \edef\@venn@end@pt@i@x{\the\@venn@intersect@ii@x}%
627          \edef\@venn@end@pt@i@y{\the\@venn@intersect@ii@y}%
628        \fi
```

Compute the end angle of the first arc.

```
629        \ifvennoldpgf
630          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
631        \else
632          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
633        \fi
634        \let\@venn@end@i@angle\pgfmathresult
635        \pgfmathsubtract{\@venn@end@i@angle}{360}%
636        \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle of the second arc.

```
637        \pgfmathsetlength{\dimen@i}{\@venn@end@pt@i@x-\@venn@Ax}%
638        \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@i@y-\@venn@Ay}%
639        \ifvennoldpgf
640          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
641        \else
642          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
643        \fi
644        \let\@venn@start@ii@angle\pgfmathresult
```

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

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

Need the point closest to *C*.

```
646        \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@i@x}%
647        \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@i@y}%
648        \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
649        \pgfmathsetlength{\dimen@i}{\@venn@Cx-\@venn@intersect@ii@x}%
650        \pgfmathsetlength{\dimen@ii}{\@venn@Cy-\@venn@intersect@ii@y}%
651        \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
652        \ifdim\dimen@<\dimen@i
653          \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
```

```
654        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
655        \edef\@venn@end@pt@ii@x{\the\@venn@intersect@i@x}%
656        \edef\@venn@end@pt@ii@y{\the\@venn@intersect@i@y}%
657      \else
658        \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
659        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
660        \edef\@venn@end@pt@ii@x{\the\@venn@intersect@ii@x}%
661        \edef\@venn@end@pt@ii@y{\the\@venn@intersect@ii@y}%
662      \fi
```

Compute the end angle of the second arc.

```
663      \ifvennoldpgf
664        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
665      \else
666        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
667      \fi
668      \let\@venn@end@ii@angle\pgfmathresult
```

Compute the start angle of the third arc.

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

Compute the end angle of the third arc.

```
677      \pgfmathsetlength{\dimen@i}{\@venn@start@pt@x-\@venn@Bx}%
678      \pgfmathsetlength{\dimen@ii}{\@venn@start@pt@y-\@venn@By}%
679      \ifvennoldpgf
680        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
681      \else
682        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
683      \fi
684      \let\@venn@end@iii@angle\pgfmathresult
```

Fill path

```
685      \path[fill=\@venn@shade] (\@venn@start@pt@x,\@venn@start@pt@y)
686      arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
687      end angle=\@venn@end@i@angle]
688      arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
689      end angle=\@venn@end@ii@angle]
690      arc[radius=\@venn@radius,start angle=\@venn@start@iii@angle,
691      end angle=\@venn@end@iii@angle] -- cycle;
692    \else
693      \fillOnlyC
694    \fi
695 }%
```

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

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

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

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

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

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

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

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

Compute the initial angle of the first arc.

```
716       \ifvennoldpgf
717         \pgfmathatantwo{\dimen@i}{\dimen@ii}%
718       \else
719         \pgfmathatantwo{\dimen@ii}{\dimen@i}%
720       \fi
721       \let\@venn@start@i@angle\pgfmathresult
```

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

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

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

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

33

```
733        \edef\@venn@end@pt@i@y{\the\@venn@intersect@i@y}%
734      \else
735        \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
736        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
737        \edef\@venn@end@pt@i@x{\the\@venn@intersect@ii@x}%
738        \edef\@venn@end@pt@i@y{\the\@venn@intersect@ii@y}%
739      \fi
```

Compute the end angle of the first arc.

```
740      \ifvennoldpgf
741        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
742      \else
743        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
744      \fi
745      \let\@venn@end@i@angle\pgfmathresult
746      \pgfmathadd{\@venn@end@i@angle}{360}%
747      \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle of the second arc.

```
748      \pgfmathsetlength{\dimen@i}{\@venn@end@pt@i@x-\@venn@Cx}%
749      \pgfmathsetlength{\dimen@ii}{\@venn@end@pt@i@y-\@venn@Cy}%
750      \ifvennoldpgf
751        \pgfmathatantwo{\dimen@i}{\dimen@ii}%
752      \else
753        \pgfmathatantwo{\dimen@ii}{\dimen@i}%
754      \fi
755      \let\@venn@start@ii@angle\pgfmathresult
```

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

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

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

```
757      \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@i@x}%
758      \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@i@y}%
759      \pgfmathsetlength{\dimen@}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
760      \pgfmathsetlength{\dimen@i}{\@venn@Ax-\@venn@intersect@ii@x}%
761      \pgfmathsetlength{\dimen@ii}{\@venn@Ay-\@venn@intersect@ii@y}%
762      \pgfmathsetlength{\dimen@i}{\dimen@i*\dimen@i+\dimen@ii*\dimen@ii}%
763      \ifdim\dimen@>\dimen@i
764        \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Cx}%
765        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Cy}%
766        \edef\@venn@end@pt@ii@x{\the\@venn@intersect@i@x}%
767        \edef\@venn@end@pt@ii@y{\the\@venn@intersect@i@y}%
768      \else
769        \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Cx}%
770        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Cy}%
771        \edef\@venn@end@pt@ii@x{\the\@venn@intersect@ii@x}%
772        \edef\@venn@end@pt@ii@y{\the\@venn@intersect@ii@y}%
773      \fi
```

Compute the end angle of the second arc.

```
774        \ifvennoldpgf
775          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
776        \else
777          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
778        \fi
779        \let\@venn@end@ii@angle\pgfmathresult
780        \pgfmathadd{\@venn@end@ii@angle}{360}%
781        \let\@venn@end@ii@angle\pgfmathresult
```

Compute the start angle of the third arc.

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

Compute the end angle of the third arc.

```
790        \pgfmathsetlength{\dimen@i}{\@venn@start@pt@x-\@venn@Bx}%
791        \pgfmathsetlength{\dimen@ii}{\@venn@start@pt@y-\@venn@By}%
792        \ifvennoldpgf
793          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
794        \else
795          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
796        \fi
797        \let\@venn@end@iii@angle\pgfmathresult
```

Fill path

```
798        \path[fill=\@venn@shade,even odd rule]
799          (0,0) rectangle (\@venn@w,\@venn@h)
800          (\@venn@start@pt@x,\@venn@start@pt@y)
801        arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
802        end angle=\@venn@end@i@angle]
803        arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
804        end angle=\@venn@end@ii@angle]
805        arc[radius=\@venn@radius,start angle=\@venn@start@iii@angle,
806        end angle=\@venn@end@iii@angle]
807        -- cycle;
808      \else
809        \path[fill=\@venn@shade,even odd rule]
810          (0,0) rectangle (\@venn@w,\@venn@h)
811        (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
812        (\@venn@Bx,\@venn@By) circle (\@venn@radius)
813        (\@venn@Cx,\@venn@Cy) circle (\@venn@radius);%
814      \fi
815 }%
```

enndiagram2sets

```
816 \newenvironment{venndiagram2sets}[1][]%
817 {%
```

Disable the keys that aren't applicable.

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

Set the key values given in the optional argument.

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

Calculate centre of A

```
821   \pgfmathsetlength{\@venn@Ax}{\@venn@hgap+\@venn@radius}%
822   \pgfmathsetlength{\@venn@Ay}{\@venn@vgap+\@venn@radius}%
```

Calculate centre of B

```
823   \pgfmathsetlength{\@venn@Bx}{\@venn@hgap+3*\@venn@radius
824     -\@venn@overlap}%
825   \setlength{\@venn@By}{\@venn@Ay}%
```

Compute dimensions of entire diagram

```
826   \pgfmathsetlength{\@venn@w}{2*\@venn@hgap+4*\@venn@radius
827     -\@venn@overlap}%
828   \pgfmathsetlength{\@venn@h}{2*\@venn@vgap+2*\@venn@radius}%
```

Define filling commands

```
829   \def\fillA{\path[fill=\@venn@shade] (\@venn@Ax,\@venn@Ay)
830     circle (\@venn@radius);}%
831   \def\fillB{\path[fill=\@venn@shade] (\@venn@Bx,\@venn@By)
832     circle (\@venn@radius);}%
833   \def\fillAll{\path[fill=\@venn@shade] (0,0)
834     rectangle (\@venn@w,\@venn@h);}%
```

Fill only set *A*

```
835   \let\fillOnlyA\@venn@fillOnlyA@twosets
```

Fill only set *B*

```
836   \let\fillOnlyB\@venn@fillOnlyB@twosets
```

Fill everything except *A*

```
837   \def\fillNotA{\path[fill=\@venn@shade,even odd rule]
838     (0,0) rectangle (\@venn@w,\@venn@h)
839     (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);}%
```

Fill everything except *B*

```
840   \def\fillNotB{\path[fill=\@venn@shade,even odd rule]
841     (0,0) rectangle (\@venn@w,\@venn@h)
842     (\@venn@Bx,\@venn@By) circle (\@venn@radius);}%
```

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

```
843   \def\fillNotAorB{%
844     \begin{scope}
845     \path[clip]
846     (0,0) rectangle (\@venn@w,\@venn@h)
847     (\@venn@Bx,\@venn@By) circle (\@venn@radius)
```

```
848        ;
849      \path[fill=\@venn@shade,even odd rule]
850      (0,0) rectangle (\@venn@w,\@venn@h)
851      (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
852        ;
853      \end{scope}
854      }%
```

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

```
855    \def\fillNotAorNotB{%
856      \path[fill=\@venn@shade,nonzero rule]
857      (0,0) rectangle (\@venn@w,\@venn@h)
858      (\@venn@Ax,\@venn@Ay) circle (\@venn@radius)
859      (0,0) rectangle (\@venn@w,\@venn@h)
860      (\@venn@Bx,\@venn@By) circle (\@venn@radius)
861        ;
862      }%
```

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

```
863    \let\fillANotB\fillOnlyA
```

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

```
864    \let\fillBNotA\fillOnlyB
```

Fill *A* intersect *B*

```
865    \def\fillACapB{%
866      \begin{scope}
867        \clip (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
868        \path[fill=\@venn@shade]
869          (\@venn@Bx,\@venn@By) circle (\@venn@radius);
870      \end{scope}
871    }%
```

Define synonym:

```
872    \let\fillBCapA\fillACapB
```

Start the tikzpicture environment.

```
873    \ifdefempty{\@venn@tikzoptions}%
874    {%
875      \def\@venn@dobegin{\begin{tikzpicture}}%
876    }%
877    {%
878      \edef\@venn@dobegin{\noexpand\begin{tikzpicture}%
879        [\expandonce\@venn@tikzoptions]}%
880    }%
881    \@venn@dobegin
```

coordinates of the Venn diagram corners

```
882    \path (0,0) coordinate (venn bottom left)
883          (0,\@venn@h) coordinate (venn top left)
884          (\@venn@w,\@venn@h) coordinate (venn top right)
885          (\@venn@w,0) coordinate (venn bottom right);
886 }%
```

End environment code

887 {%

Draw outlines

```
888     \ifvennshowframe
889       \draw (venn bottom left) rectangle (\@venn@w,\@venn@h);
890     \else
891       \path (venn bottom left) rectangle (\@venn@w,\@venn@h);
892     \fi
893     \draw (\@venn@Ax,\@venn@Ay) circle (\@venn@radius);
894     \draw (\@venn@Bx,\@venn@By) circle (\@venn@radius);
```

Draw labels

```
895     \draw (\@venn@Ax,\@venn@Ay) node[above,left] (labelOnlyA)
896       {\@venn@label@OnlyA};
897     \draw (\@venn@Bx,\@venn@By) node[above,right] (labelOnlyB)
898       {\@venn@label@OnlyB};
```

Region labels

```
899     \draw (\@venn@vgap,\@venn@hgap) node (labelNotAB) {\@venn@label@NotAB};
900     \draw (\@venn@Ax,\@venn@Ay+\@venn@radius)
901       node[below] (labelA) {\@venn@label@A};
902     \draw (\@venn@Bx,\@venn@By+\@venn@radius)
903       node[below] (labelB) {\@venn@label@B};
904     \draw (0.5*\@venn@w,0.5*\@venn@h) node (labelAB) {\@venn@label@AB};
905     \@postvennhook
906   \end{tikzpicture}
907 }
```

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

908 \newcommand*\@venn@fillOnlyA@twosets{%

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

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

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

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

Compute the start angle for the first arc.

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

Compute the end angle for the first arc.

```
919       \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Ax}%
920       \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@Ay}%
```

38

```
921        \ifvennoldpgf
922          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
923        \else
924          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
925        \fi
926        \let\@venn@end@i@angle\pgfmathresult
927        \pgfmathadd{\@venn@end@i@angle}{360}%
928        \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle for the second arc.

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

Compute the end angle for the second arc.

```
937        \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Bx}%
938        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@By}%
939        \ifvennoldpgf
940          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
941        \else
942          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
943        \fi
944        \let\@venn@end@ii@angle\pgfmathresult
945        \pgfmathadd{\@venn@start@ii@angle}{360}%
946        \let\@venn@start@ii@angle\pgfmathresult
```

Fill the path

```
947        \path[fill=\@venn@shade]
948        (\@venn@intersect@i@x,\@venn@intersect@i@y)
949        arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
950        end angle=\@venn@end@i@angle]
951        arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
952        end angle=\@venn@end@ii@angle]
953        -- cycle;
954      \else
955        \fillOnlyA
956      \fi
957 }%
```

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

```
958 \newcommand*\@venn@fillOnlyB@twosets{%
```

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

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

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

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

Compute the start angle for the first arc.

```
961        \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Bx}%
962        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@By}%
963        \ifvennoldpgf
964          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
965        \else
966          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
967        \fi
968        \let\@venn@start@i@angle\pgfmathresult
```

Compute the end angle for the first arc.

```
969        \pgfmathsetlength{\dimen@i}{\@venn@intersect@ii@x-\@venn@Bx}%
970        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@ii@y-\@venn@By}%
971        \ifvennoldpgf
972          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
973        \else
974          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
975        \fi
976        \let\@venn@end@i@angle\pgfmathresult
977 %      \pgfmathadd{\@venn@end@i@angle}{360}%
978 %      \let\@venn@end@i@angle\pgfmathresult
```

Compute the start angle for the second arc.

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

Compute the end angle for the second arc.

```
987        \pgfmathsetlength{\dimen@i}{\@venn@intersect@i@x-\@venn@Ax}%
988        \pgfmathsetlength{\dimen@ii}{\@venn@intersect@i@y-\@venn@Ay}%
989        \ifvennoldpgf
990          \pgfmathatantwo{\dimen@i}{\dimen@ii}%
991        \else
992          \pgfmathatantwo{\dimen@ii}{\dimen@i}%
993        \fi
994        \let\@venn@end@ii@angle\pgfmathresult
995 %      \pgfmathadd{\@venn@start@ii@angle}{360}%
996 %      \let\@venn@start@ii@angle\pgfmathresult
```

Fill the path

```
997        \path[fill=\@venn@shade]
998        (\@venn@intersect@i@x,\@venn@intersect@i@y)
999        arc[radius=\@venn@radius,start angle=\@venn@start@i@angle,
```

```
1000        end angle=\@venn@end@i@angle]
1001        arc[radius=\@venn@radius,start angle=\@venn@start@ii@angle,
1002        end angle=\@venn@end@ii@angle]
1003          -- cycle;
1004     \else
1005        \fillOnlyB
1006     \fi
1007 }%
```

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.