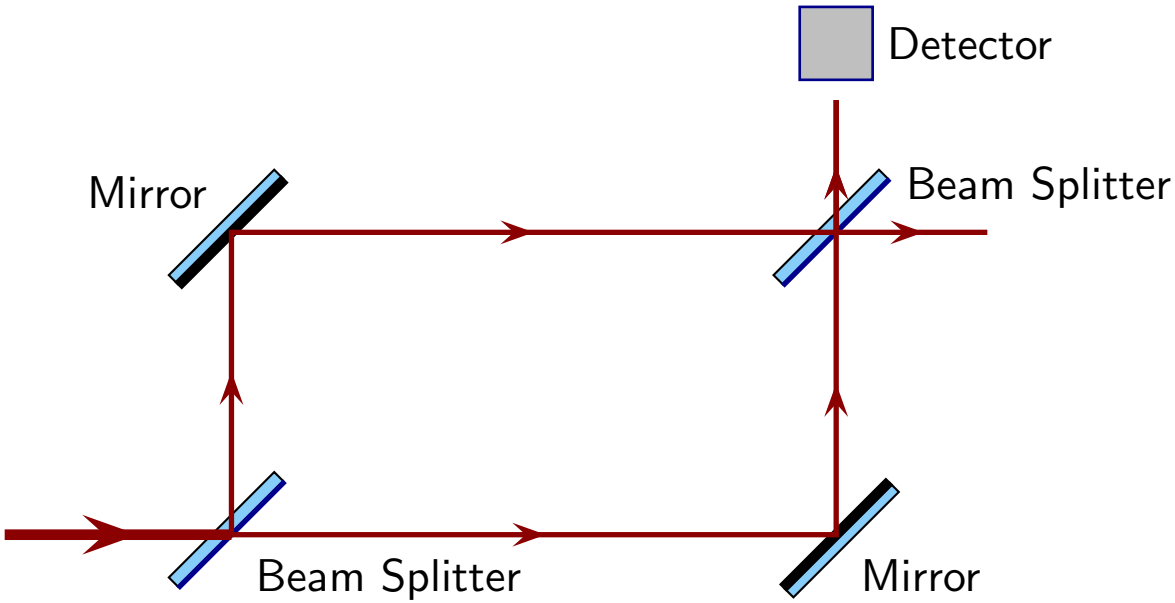
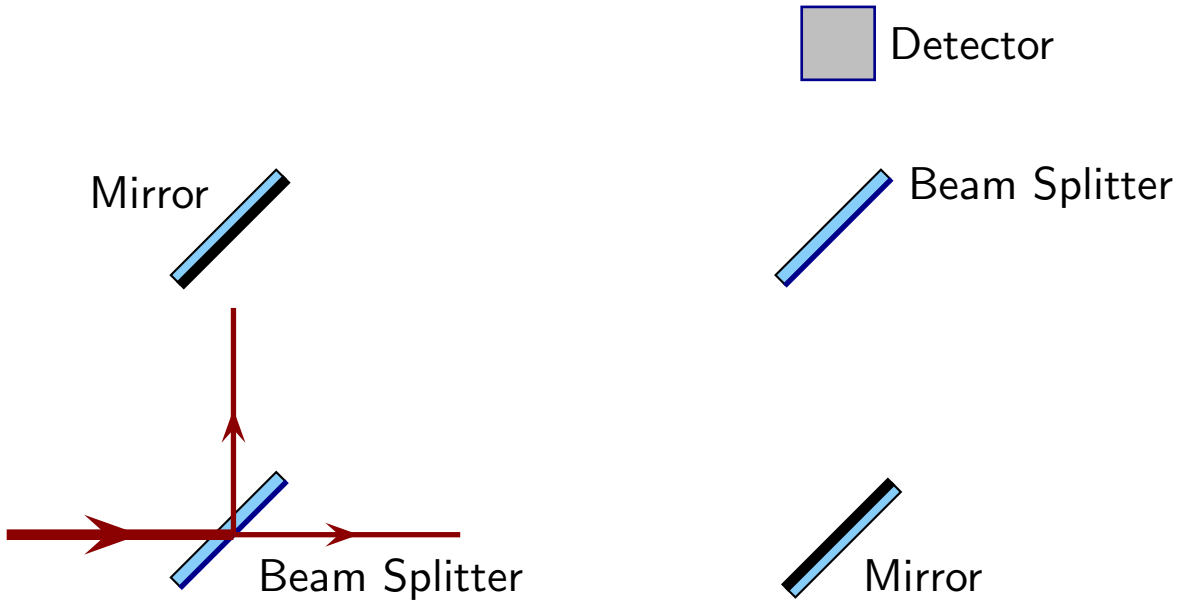
Mach-Zehnder Interferometer: Schematic

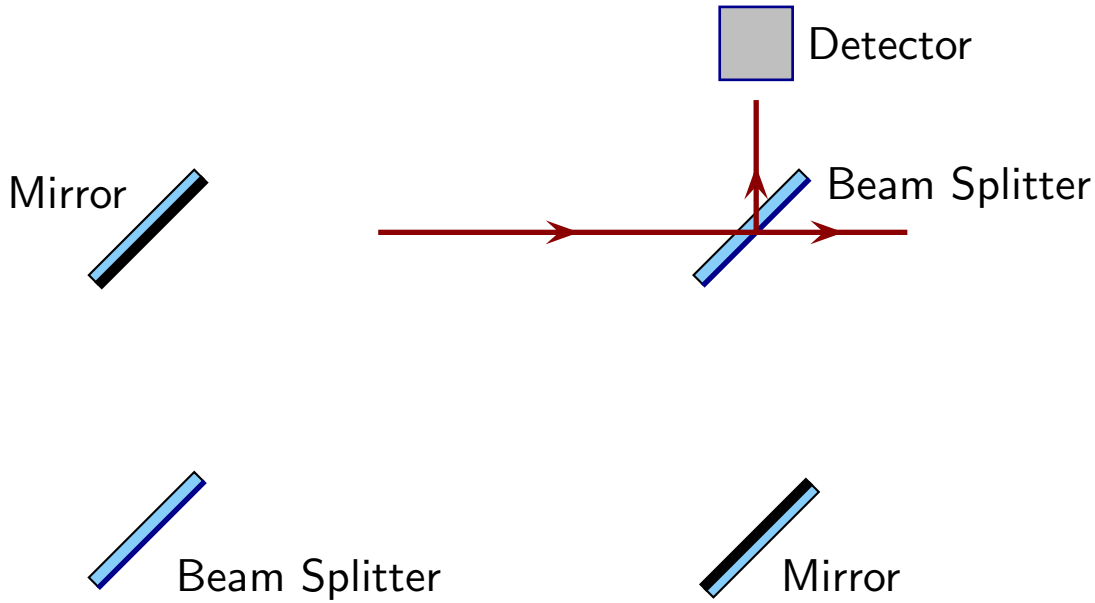


Mach-Zehnder Interferometer: First Beam Splitter



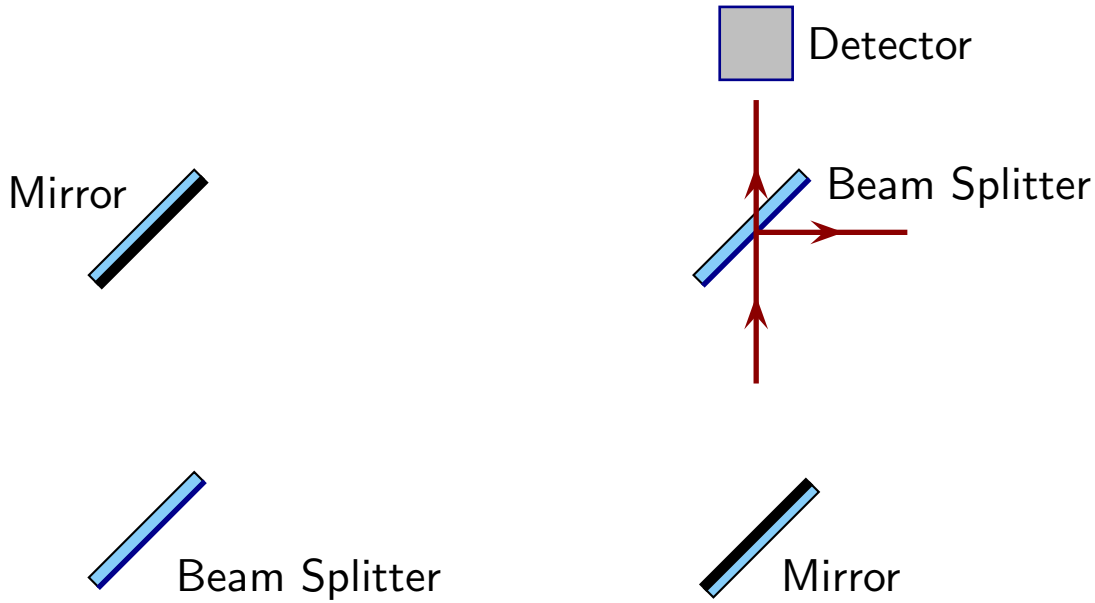
First beam splitter transmits 50% of incident light, reflects 50% of incident light.

Mach-Zehnder Interferometer: Second Beam Splitter



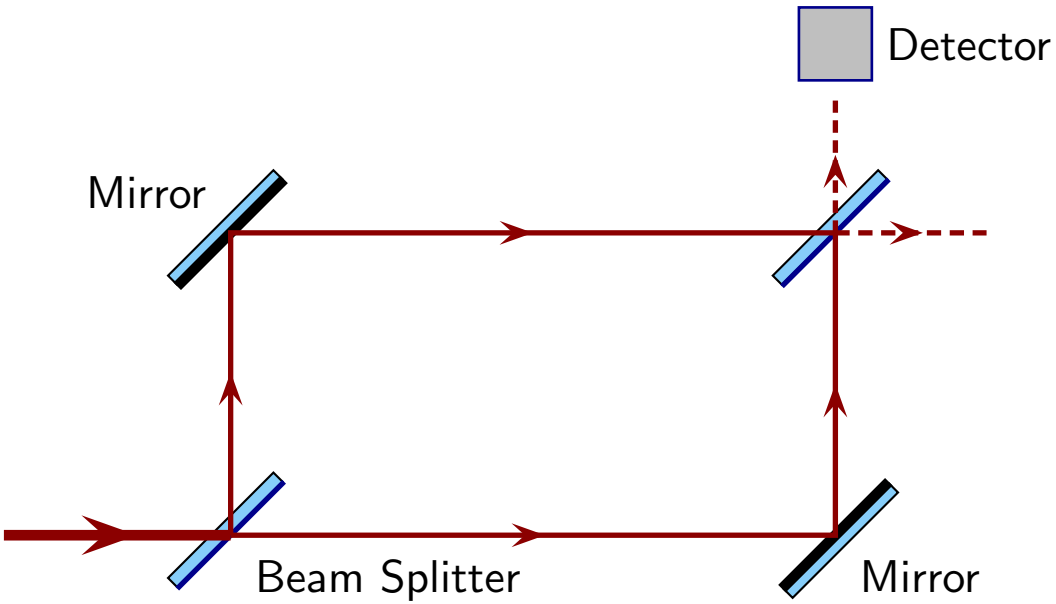
Second beam splitter transmits 50% of incident light, reflects 50% of incident light.

Mach-Zehnder Interferometer: Second Beam Splitter



Second beam splitter transmits 50% of incident light, reflects 50% of incident light.

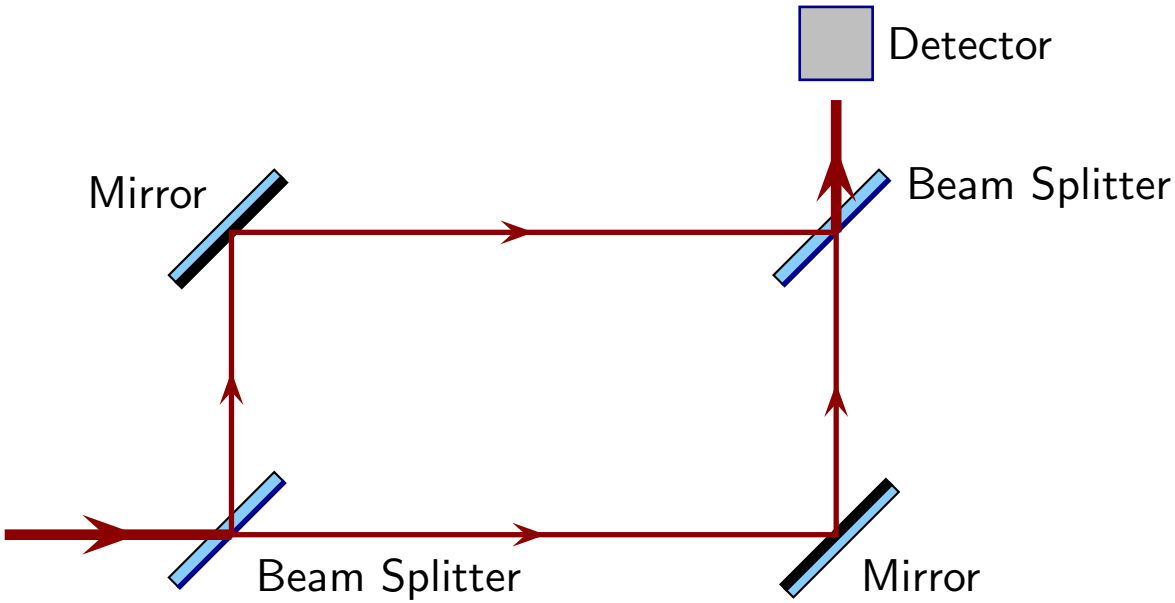
Question 1



What fraction of initial light arrives at detector?

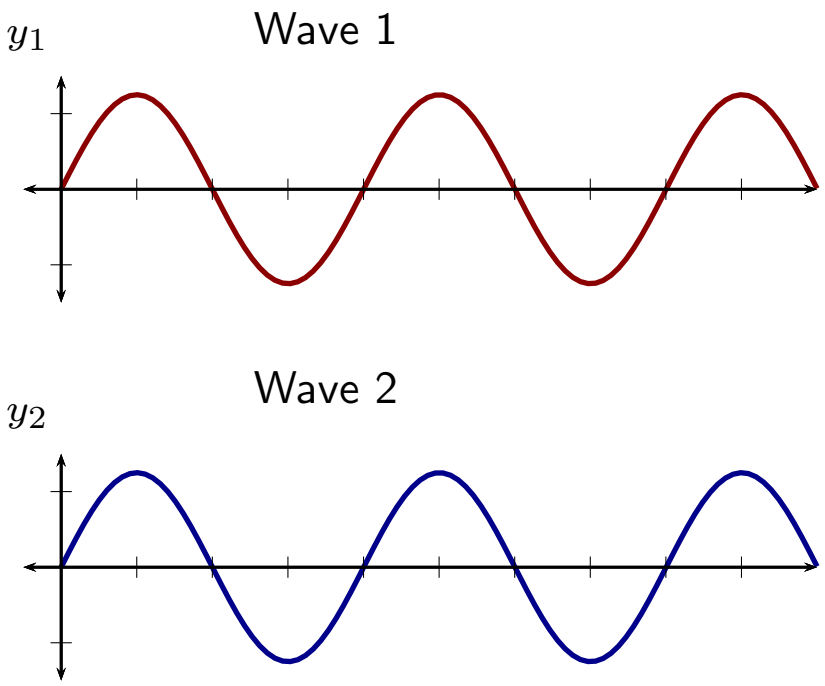
1. 0%
2. 25%
3. 50%
4. 75%
5. 100%

Mach-Zehnder Interferometer: Schematic

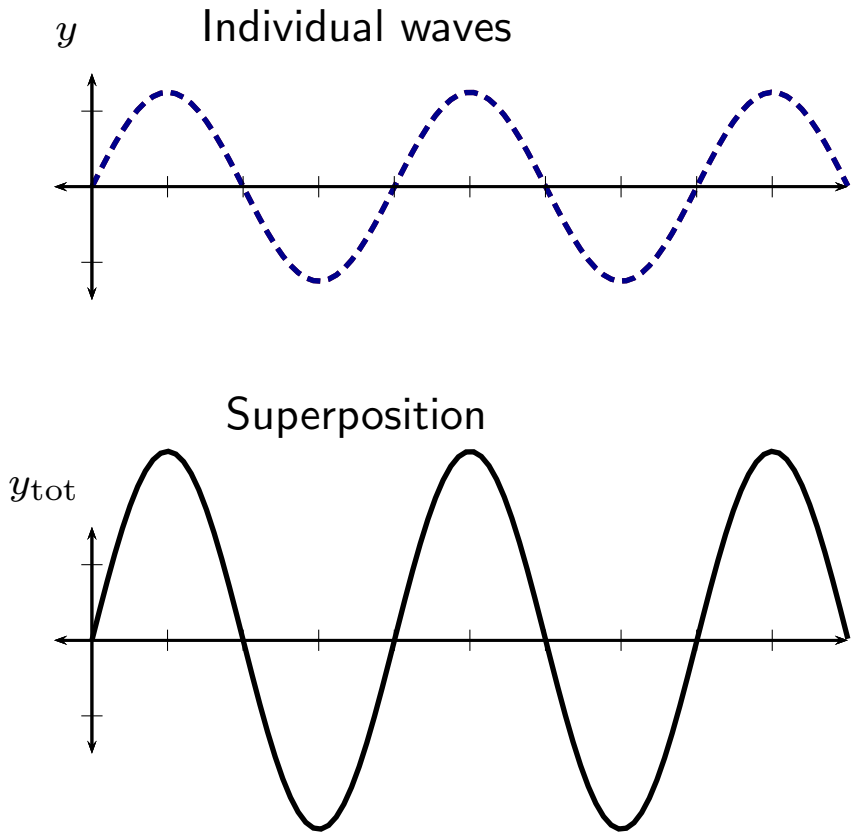


General Interference I

Snapshots of two waves at $t = 0\,\mathrm{s}$ in the same medium are illustrated whose phase difference is $\Delta\phi = 0$.

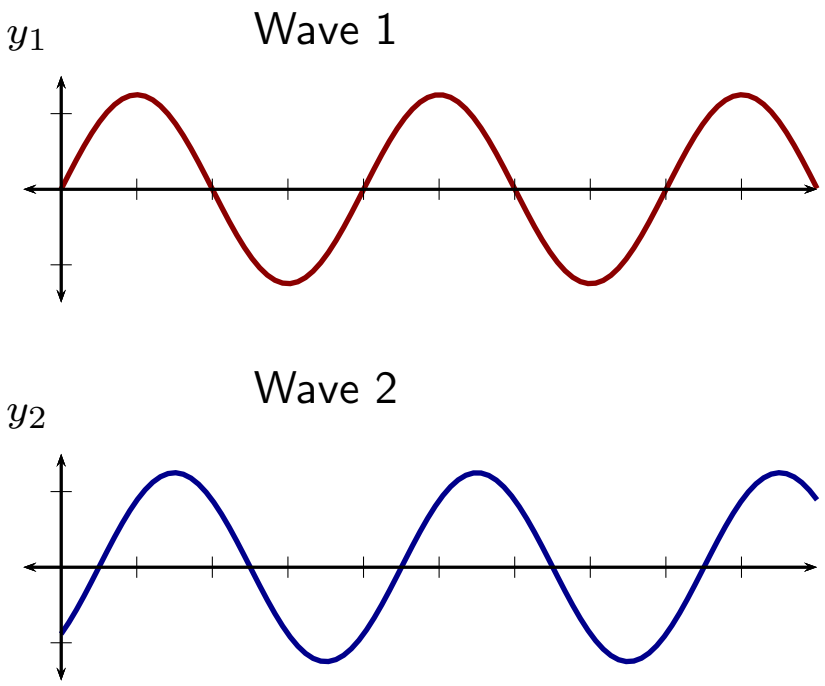


The superposition of the two waves is:

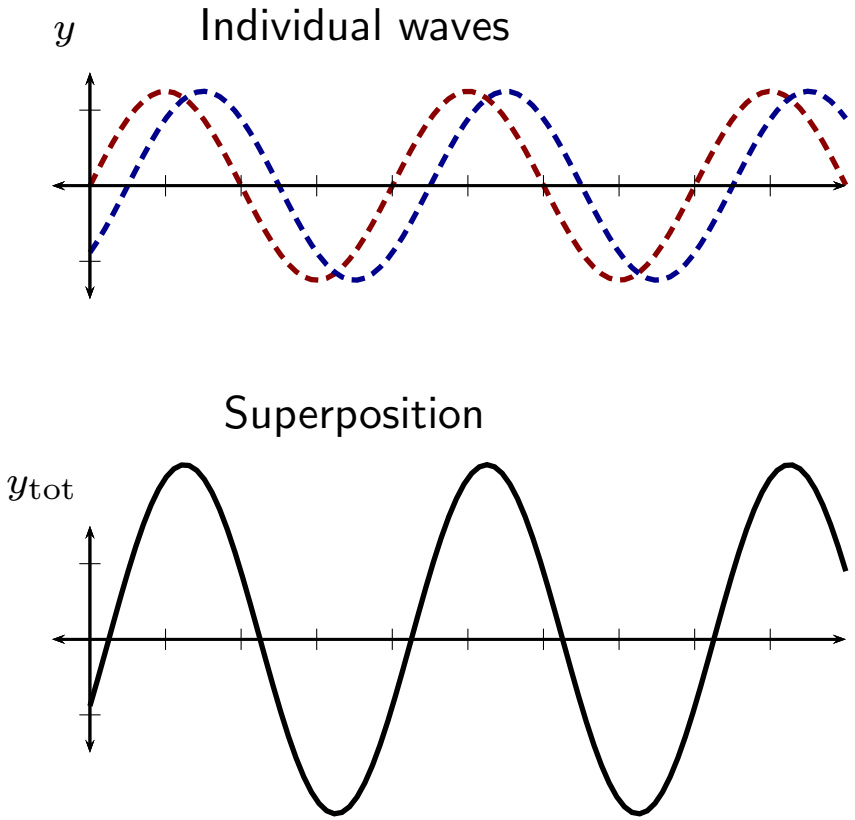


General Interference II

Snapshots of two waves at $t = 0\,\mathrm{s}$ in the same medium are illustrated whose phase difference is $\Delta\phi = \frac{\pi}{4}$.

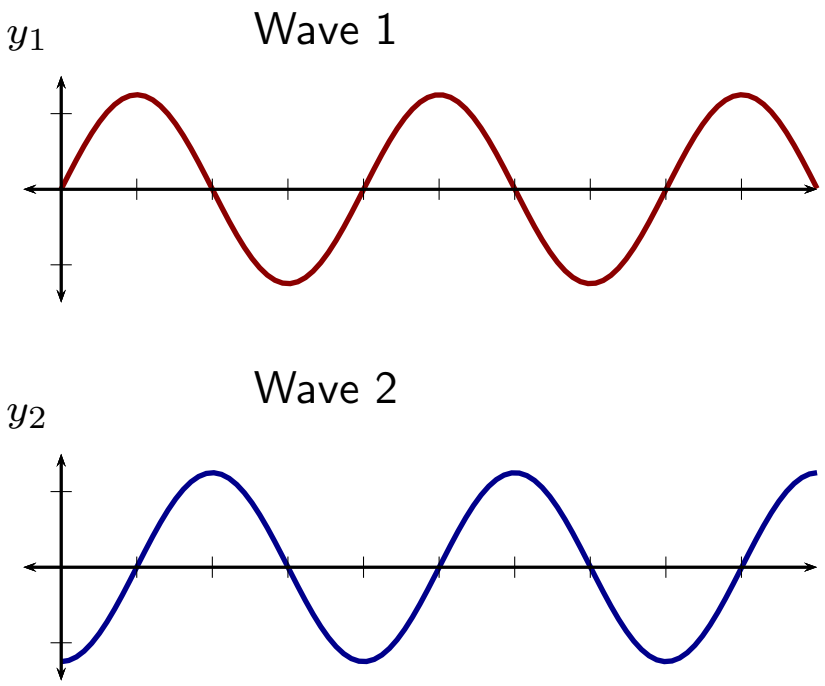


The superposition of the two waves is:

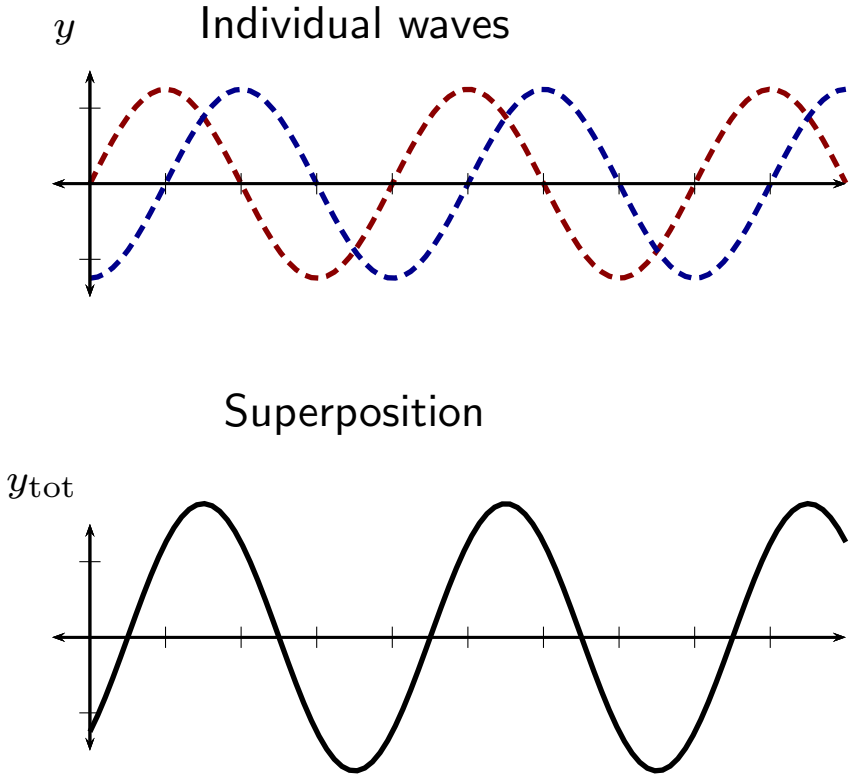


General Interference III

Snapshots of two waves at $t = 0\,\mathrm{s}$ in the same medium are illustrated whose phase difference is $\Delta\phi = \frac{\pi}{2}$.



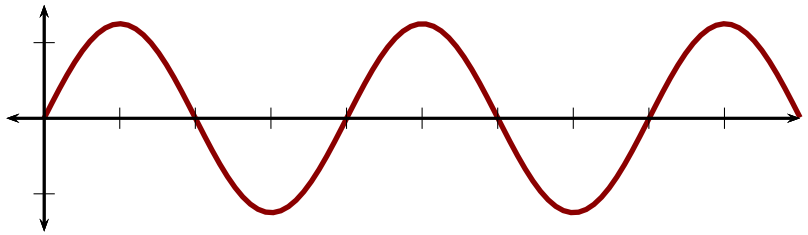
The superposition of the two waves is:



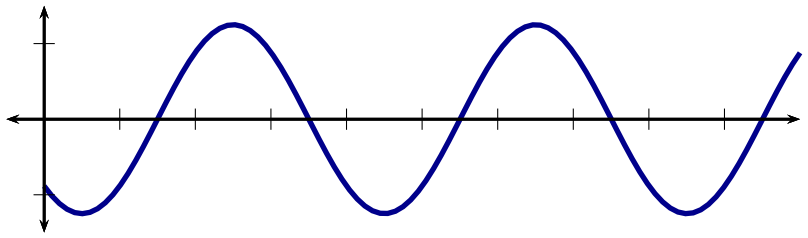
General Interference IV

Snapshots of two waves at $t = 0\,\mathrm{s}$ in the same medium are illustrated whose phase difference is $\Delta\phi = \frac{3\pi}{4}$.

y_1 Wave 1

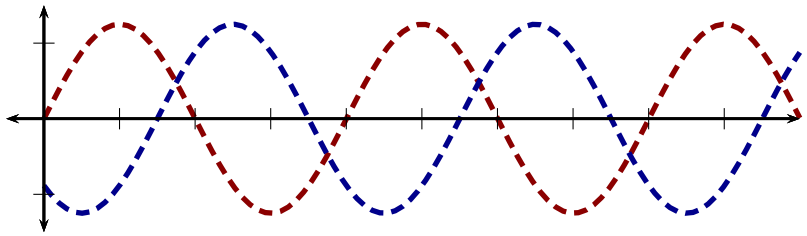


y_2 Wave 2



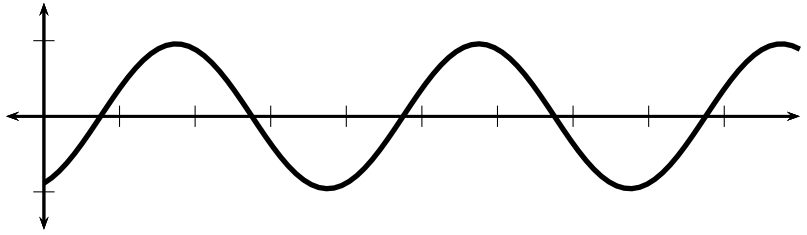
The superposition of the two waves is:

y Individual waves



Superposition

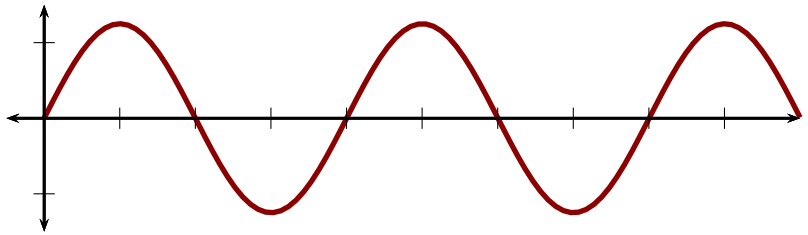
y_{tot}



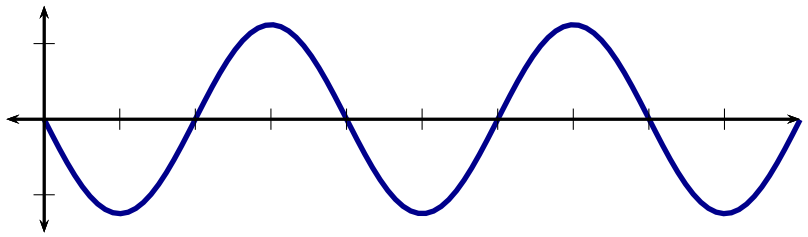
General Interference V

Snapshots of two waves at $t = 0\,\mathrm{s}$ in the same medium are illustrated whose phase difference is $\Delta\phi = \pi$.

y_1 Wave 1

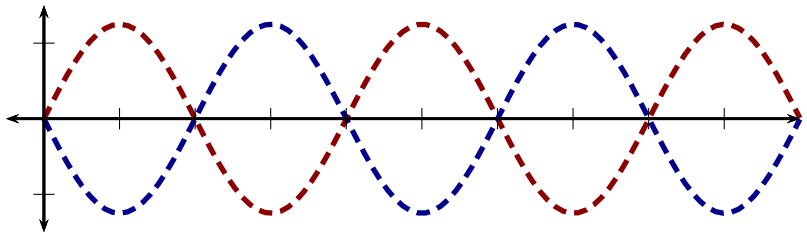


Wave 2 y_2

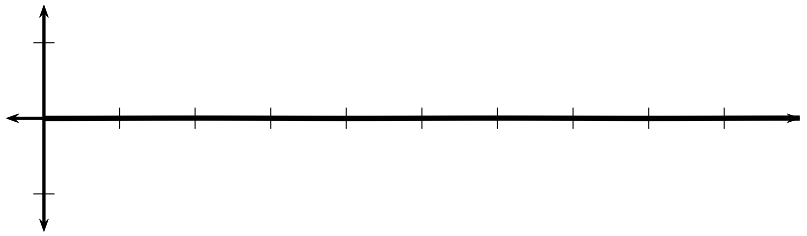


The superposition of the two waves is:

y Individual waves

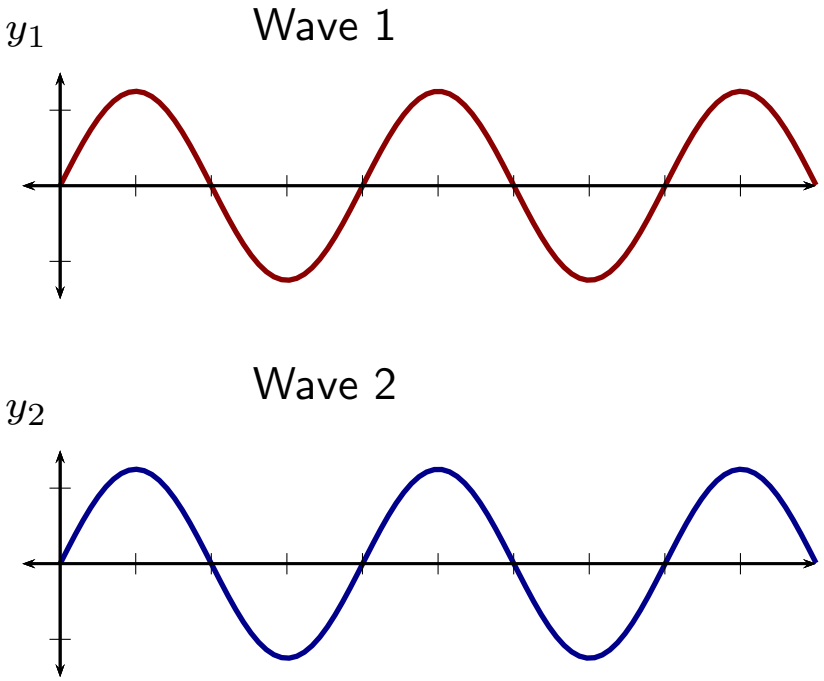


Superposition y_{tot}

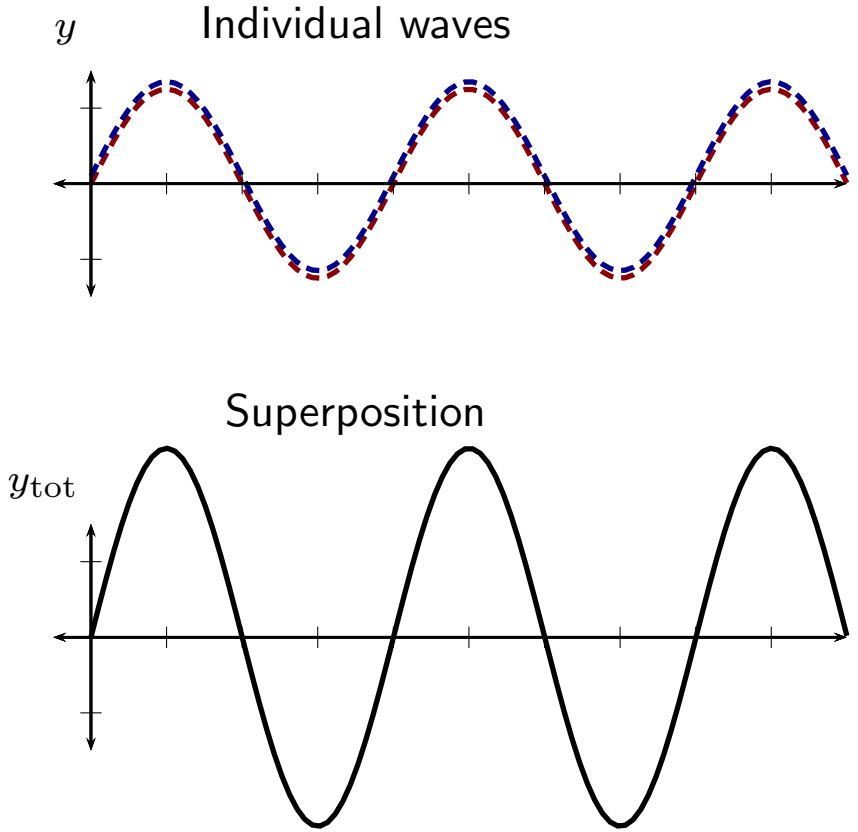


Constructive Interference

Snapshots of two waves at one instant in the same medium.

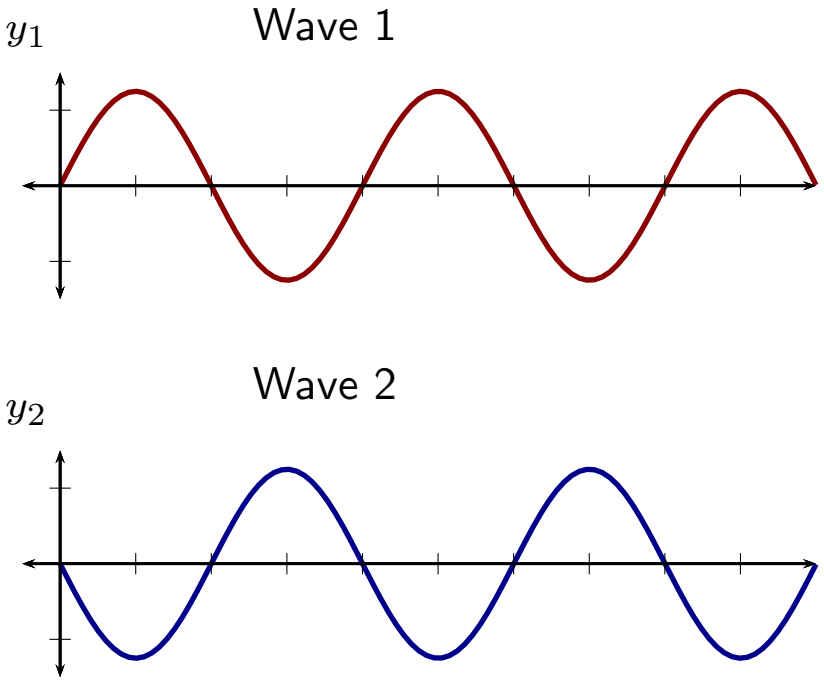


The superposition of the two waves is:

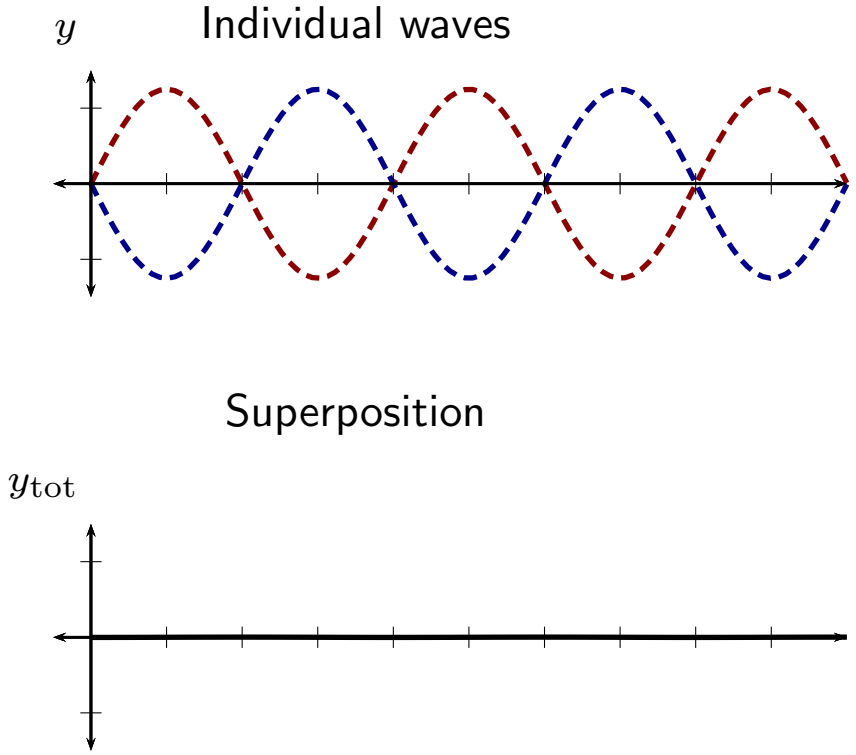


Destructive Interference

Snapshots of two waves at one instant in the same medium.

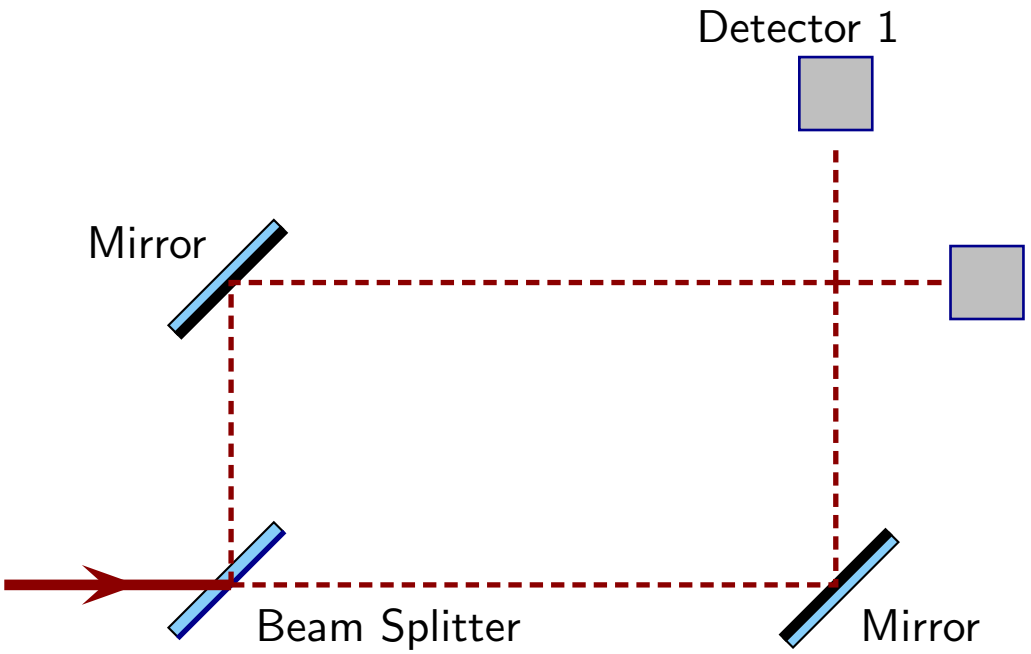


The superposition of the two waves is:



Question 2

Single photons enter the interferometer, one at a time, at the lower left.

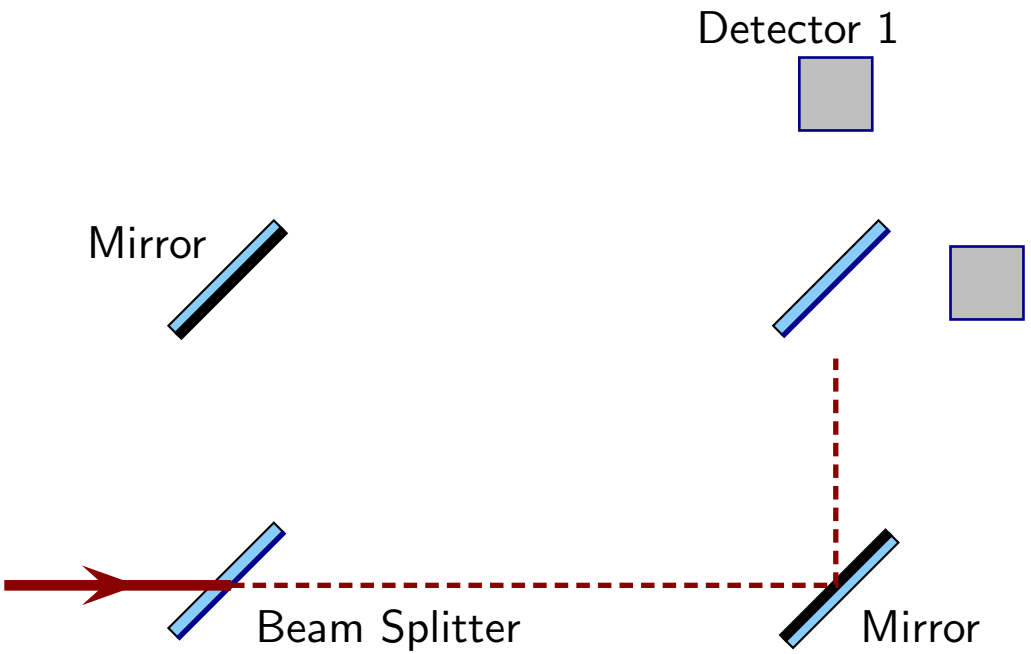


What fraction of the photons arrive at detector 1?

1. 0%
2. 25%
3. 50%
4. 75%
5. 100%

Question 3

Single photons enter the interferometer, one at a time, at the lower left. Consider photons that only pass along the lower arm toward the second beamsplitter.



What fraction of these photons arrive at detector 1?

1. 0%
2. 25%
3. 50%
4. 75%
5. 100%