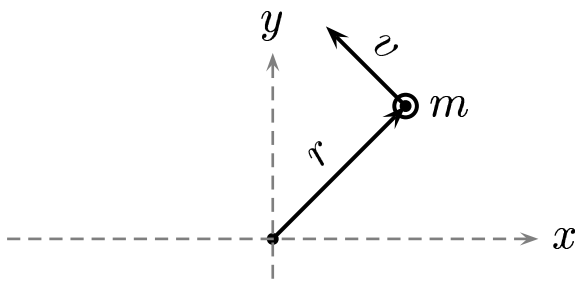
Intuitively we expect the centripetal force should depend on r, m, and v, and only on these variables.

Assume: The form of the force to be $F = k\,m^x\,r^y\,v^z$, where k is dimensionless.



Determine expressions for x, y, and z in the function $F = k\,m^x\,r^y\,v^z$.

A) $x = 1\,,\quad y - z = 1\,,\quad z = -2$
B) $x = 1\,,\quad y + z = 1\,,\quad z = 2$
C) $x = 1\,,\quad y + z = 1\,,\quad z = -2$
D) $x = 2\,,\quad y + z = 2\,,\quad z = -2$
E) $x = 1\,,\quad y + z = 2\,,\quad z = 2$

$$[\mathrm{F}] = [\mathrm{m\,a}] = \mathrm{M}\,\frac{\mathrm{L}}{\mathrm{T}^2} = \mathrm{M\,L\,T}^{-2}\,,$$

$$[\mathrm{k\,m}^{\mathrm{x}}\,\mathrm{r}^{\mathrm{y}}\,\mathrm{v}^{\mathrm{z}}] = \mathrm{M}^{\mathrm{x}}\,\mathrm{L}^{\mathrm{y}}\,\frac{\mathrm{L}^{\mathrm{z}}}{\mathrm{T}^{\mathrm{z}}} = \mathrm{M}^{\mathrm{x}}\,\mathrm{L}^{\mathrm{y+z}}\,\mathrm{T}^{-\mathrm{z}}$$

Therefore $\mathrm{M\,L\,T}^{-2} = \mathrm{M}^{\mathrm{x}}\,\mathrm{L}^{\mathrm{y+z}}\,\mathrm{T}^{-\mathrm{z}}$
By equating powers of M, L, and T, we have $x = 1$, $y + z = 1$, and $z = 2$.
Or, substituting $z = 2$ into $y + z = 1$, we have $y = -1$.
That is, $x = 1$, $y = -1$, and $z = 2$, and the equation for F is

$$F = m^1\,\frac{v^2}{r^1} = m\,\frac{v^2}{r}\,,$$

as expected. $F = m^1\,\dfrac{v^2}{r^1} = m\,\dfrac{v^2}{r}$ is commonly called the centripetal force.

Answer **B**.