Formula sheet

1. Mirror equation $\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}$, $f=\frac{r}{2}$.
2. Thin lens equation $\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}$.
3. Standing wave frequencies on a string with both ends fixed: $f_n=\frac{nv}{2L}$, $n=1,2,3,\ldots$
4. Standing wave frequencies on a string with only one end fixed (or pipes with one end open and one end stopped): $f_n=\frac{nv}{4L}$, $n=1,3,5,\ldots$
5. Lens-maker's equation: $\frac{1}{f}=\left(\frac{n_l}{n_m}-1\right)\left(\frac{1}{r_1}-\frac{1}{r_2}\right)$.
6. Image magnification: $m=-\frac{s'}{s}$.
7. Speed of a wave on a string: $v=\sqrt{\frac{T}{\mu}}$.
8. The Decibel scale for sound: $\beta=10log\left(\frac{I}{I_0}\right)$.
9. Doppler shift due to moving source: $f_r=\frac{v}{v\pm u_s}$.
10. Doppler shift due to moving receiver: $f_r=\frac{v\pm u_r}{v}$.
11. Beat: $f_{beat}=f_1-f_2$.
12. Shock wave: $\sin\theta=\frac{v}{u}$.
13. Double slit interference: $y_m=\pm\frac{m\lambda L}{d}$.
14. Refraction at a spherical interface: $\frac{n_1}{s}+\frac{n_2}{s'}=\frac{n_2-n_1}{r}$.
15. Sign rules for mirrors: s is +ve/-ve if object is in front/behind mirror.
    s' is +ve/-ve if image is in front/behind mirror.
    f/r +ve/-ve if mirror is concave/convex.
16. Sign rules for refraction:
    Radius of curvature: Positive if centre of curvature on the same side of the outgoing ray. (convex towards object); otherwise, it is negative (concave towards object).
    s': Positive if image is formed on the same side of the outgoing ray. (real image); otherwise, it is negative.
    s: Positive if object on the same side of the incoming light.
    Real images form on the side of a refracting surface that is opposite the object, and virtual images form on the same side of the object.