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| **Relationships Required for Advanced Higher Physics** |
| $$v=\frac{ds}{dt}$$$$a=\frac{dv}{dt}=\frac{d^{2}s}{dt^{2}}$$$$v=u+at$$$$s=ut+\frac{1}{2}at^{2}$$$$v^{2}=u^{2}+2as$$$$ω=\frac{dθ}{dt}$$$$α=\frac{dω}{dt}=\frac{d^{2}θ}{dt^{2}}$$$$ω=ω\_{0}+αt$$$$θ=ω\_{0}t+\frac{1}{2}αt^{2}$$$$ω^{2}=ω\_{0}^{2}+2αθ$$$$s=rθ$$$$v=rω$$$$a\_{t}=rα$$$$a\_{r}=\frac{v^{2}}{r}=rω^{2}$$$$F=\frac{mv^{2}}{r}=mrω^{2}$$$$I=\sum\_{}^{}mr^{2}$$$$τ=Fr$$$$τ=Iα$$$$L=mvr=mr^{2}ω$$$$L=Iω$$ | $$E\_{k}\_{(rotational)}=\frac{1}{2}Iω^{2}$$$$E\_{P}=E\_{k\_{(translational)}}+E\_{k}\_{(rotational)}$$$$F=\frac{GMm}{r^{2}}$$$$F=\frac{GMm}{r^{2}}=\frac{mv^{2}}{r}=mrω^{2}=mr\left(\frac{2π}{T}\right)^{2}$$$$V=-\frac{GM}{r}$$$$v\_{esc}=\sqrt{\frac{2GM}{r}}$$$$r\_{Schwarzchild}=\frac{2GM}{c^{2}}$$$$b=\frac{L}{4πd^{2}}$$$$\frac{P}{A}=σT^{4}$$$$L=4πr^{2}σT^{4}$$$$E=hf$$$$mvr=\frac{nh}{2π}$$$$λ=\frac{h}{p}$$$$∆x∆p\_{x}\geq \frac{h}{4π}$$$$∆E∆t\geq \frac{h}{4π}$$$$F=qvB$$$$F=\frac{mv^{2}}{r}$$ |
| $$F=-ky$$$$ω=2πf=\frac{2π}{T}$$$$a=\frac{d^{2}y}{dt^{2}}=-ω^{2}y$$$y=A\sin(ωt)$ or $y=A\cos(ωt)$$$v=\pm ω\sqrt{\left(A^{2}-y^{2}\right)}$$$$E\_{k}=\frac{1}{2}mω^{2}(A^{2}-y^{2})$$$$E\_{P}=\frac{1}{2}mω^{2}y^{2}$$$$E=kA^{2}$$$$y=A\sin(2π\left(ft-\frac{x}{λ}\right))$$$$ϕ=\frac{2πx}{λ}$$$$opd=n×gpd$$$opd=mλ$ or $\left(m+\frac{1}{2}\right)λ$ where $m=0,1,2…$$$∆x=\frac{λl}{2d}$$$$d=\frac{λ}{4n}$$$$∆x=\frac{λD}{d}$$$$n=\tan(i\_{P})$$ | $$F=QE$$$$V=Ed$$$$W=QV$$$$E\_{k}=\frac{1}{2}mv^{2}$$$$B=\frac{μ\_{0}I}{2πr}$$$$F=IlB\sin(θ)$$$$F=qvB$$$$τ=RC$$$$X\_{C}=\frac{V}{I}$$$$X\_{C}=\frac{1}{2πfC}$$$$ε=-L\frac{dI}{dt}$$$$E=\frac{1}{2}LI^{2}$$$$X\_{L}=\frac{V}{I}$$$$X\_{L}=2πfL$$$$c=\frac{1}{\sqrt{ε\_{0}μ\_{0}}}$$$$\frac{∆W}{W}=\sqrt{\left(\frac{∆X}{X}\right)^{2}+\left(\frac{∆Y}{Y}\right)^{2}+\left(\frac{∆Z}{Z}\right)^{2}}$$$$\left(\frac{∆W^{n}}{W^{n}}\right)=n\left(\frac{∆W}{W}\right)$$ |
| **Additional relationships****Circle**circumference = $2πr$area = $πr^{2}$**Sphere**area = $4πr^{2}$volume = $\frac{4}{3}πr^{3}$**Trigonometry**$$\sin(θ)=\frac{opposite}{hypotenuse}$$$$\cos(θ)=\frac{adjacent}{hypotenuse}$$$$\tan(θ)=\frac{opposite}{adjacent}$$$$sin^{2}θ+cos^{2}θ=1$$**Moment of inertia**point mass$$I=mr^{2}$$rod about centre$I=\frac{1}{12}ml^{2}$ rod about end$I=\frac{1}{3}ml^{2}$ disc about centre$I=\frac{1}{2}mr^{2}$ sphere about centre$I=\frac{2}{5}mr^{2}$  | **Table of standard derivatives**

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| $$f\left(x\right)$$ | $$f'(x)$$ |
| $$\sin(ax)$$ | $$a\cos(ax)$$ |
| $$\cos(ax)$$ | $$-a\cos(ax)$$ |

**Table of standard integrals**

|  |  |
| --- | --- |
| $$f\left(x\right)$$ | $$∫f\left(x\right) dx$$ |
| $$\sin(ax)$$ | $$-\frac{1}{a}\cos(ax+C)$$ |
| $$\cos(ax)$$ | $$\frac{1}{a}\sin(ax+C)$$ |

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