

$$\begin{aligned}
 & \cos \varphi + \cos 2\varphi + \cos 3\varphi + \dots + \cos n\varphi = \frac{\cos \frac{\varphi}{2} - \cos \frac{(2n+1)\varphi}{2}}{2 \sin \frac{\varphi}{2}} \\
 & \text{sh}(x+y) = \text{sh}x \text{ch}y + \text{ch}x \text{sh}y \\
 & (a+b)^2 = a^2 + 2ab + b^2 \\
 & b = \log_a N \quad a^t = N \\
 & b_n = b_1 q^{n-1} \quad S = \frac{b_1}{1-q} \\
 & r = \frac{e^x - e^{-x}}{2} \quad b_n = \sqrt{b_{n-k} b_{n+k}} \\
 &)h \quad S_n = \frac{b(1-q^n)}{1-q} = \frac{b_1 - b_n q}{1-q} \\
 & +h^2 - \frac{1}{2}gt^2 = gth + \frac{1}{2}gh^2 \\
 & \frac{v^2}{2} = gt \quad v(t) = gt \\
 & \frac{s(t+h)-s(t)}{h} (cf)' = cf' \\
 & e^{ix} = \cos x + i \sin x \\
 & \text{ch}(x+y) = \text{ch}x \text{ch}y + \text{sh}x \text{sh}y \\
 & \text{ch}2x = \text{ch}^2x + \text{sh}^2x \\
 & \text{cth}x = \frac{\text{ch}x}{\text{sh}x} = \frac{e^x + e^{-x}}{e^x - e^{-x}} \\
 & \text{th}x = \frac{\text{sh}x}{\text{ch}x} = \frac{e^x - e^{-x}}{e^x + e^{-x}} \\
 & (a+b)^3 = (a^2 + 2ab + b^2)(a+b) = a^3 + a^2b + 2ab^2 + b^3 \\
 & S_n = \frac{2a_1 + (n-1)d}{2} n \\
 & a_n = \frac{a_{n+1} + a_{n-1}}{2} \\
 & a_n = \frac{a_{n+k} + a_{n-k}}{2}, n \geq k \\
 & s(t+h) - s(t) = \frac{1}{2}g(t+h)^2 - \frac{1}{2}gt^2 = \frac{1}{2}g(t^2 + 2th + h^2) - \frac{1}{2}gt^2 \\
 & \frac{s(t+h)-s(t)}{h} \approx v(t) \quad v(t) = \lim_{h \rightarrow 0} \frac{\frac{1}{2}g(t+h)^2 - \frac{1}{2}gt^2}{h} \\
 & \frac{s(t+h)-s(t)}{h} = gt + \frac{1}{2}gh \quad v(t) = \lim_{h \rightarrow 0} (gt + \frac{1}{2}gh) = gt \\
 & \frac{v(t+h)-v(t)}{h} = g \quad v(t+h) - v(t) = g(t+h) - gt
 \end{aligned}$$

156RCs

$$\begin{aligned}
 & = 2px + \lambda x^2 \quad a = r \cos \varphi \quad b = r \sin \varphi \\
 & \arccos x = \frac{\sqrt{1-x^2}}{2} - \arcsin x \quad y^2
 \end{aligned}$$

Sincerest appreciation dedicated to
2022 VV156 TAs

Yishen Zhou, Junhao Li and Jiahe Huang,
as well as all previous VV156 TAs.

1. About Honors Calculus

2023FA-VV156

- ① Limits
- ② Derivatives and Integrals
- ③ Series
- ④ Polar Coordinates
- ⑤ Basic Differential Equations

2023SU-VV255

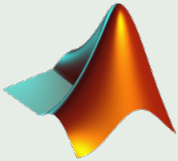
- ① Simple Linear Algebra
- ② Partial Derivatives
- ③ Multiple Integrals

2024FA-VV256

- ① Differential Equations
- ② Deeper Linear Algebra
- ③ Fourier Transform and Laplace Transform

Other courses might contribute to Honors Calculus: VV214, VE203, etc.

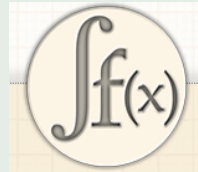
MATLAB:



Mathematica:



Integration with Steps:



<https://www.integral-calculator.com/>

You had better understand the contents on green slides. They are relatively fundamental.

The content shown on blue slides may be relatively hard, but may contribute to getting high marks in the exams more or less. Do not worry when you cannot handle it.

Those on pink slides are just some interesting problems and crazy thoughts. Maybe they are of little application in exams, but they are quite interesting.

$$\begin{aligned}
 \varphi &= a^i N \quad (\mathcal{F} + \mathcal{H}) = \mathcal{F} + \mathcal{H} = f + g \quad i^3 = i^2 i = -1 \quad \sin \varphi + \sin 2\varphi + \sin 3\varphi + \dots + \sin n\varphi \\
 \frac{\varphi}{2} N &= 10^n x \quad (k \mathcal{F}) = k \mathcal{F} \quad x^3 + px + q = 0 \quad i^2 = i^2 i^2 = 1 \quad \frac{\sin \frac{(2n+1)\varphi}{2}}{2 \sin \frac{\varphi}{2}} \\
 \cos \varphi + \cos 2\varphi + \cos 3\varphi + \dots + \cos n\varphi &= \frac{\cos \frac{\varphi}{2} - \cos \frac{(2n+1)\varphi}{2}}{2 \sin \frac{\varphi}{2}} \quad \text{sh}(x+y) = \text{sh}x \text{ch}y + \text{ch}x \text{sh}y \\
 &= \frac{\cos \frac{\varphi}{2} - \cos \frac{(2n+1)\varphi}{2}}{2 \sin \frac{\varphi}{2}} \quad \text{sh}(x+y) = \text{sh}x \text{ch}y + \text{ch}x \text{sh}y \quad \text{ch} 2x = \text{ch}^2 x + \text{sh}^2 x \\
 b &= \log_a N \quad a^i = N \quad (a^i b^i)(x^i y^i) = \text{cth} x = \frac{\text{ch} x}{\text{sh} x} = \frac{e^x + e^{-x}}{e^x - e^{-x}} \\
 b_n &= b_1 q^{n-1} \quad S = \frac{b_1}{1-q} \quad = (ax+by)^2 - (ay-bx)^2 \quad \text{th} x = \frac{\text{sh} x}{\text{ch} x} = \frac{e^x - e^{-x}}{e^x + e^{-x}} \\
 r &= \frac{e^x - e^{-x}}{2} \quad b_n = \sqrt{b_{n-k} b_{n+k}} \quad (a+b)^3 = (a^2+2ab+b^2)(a+b) = \text{ch} x = \frac{e^x + e^{-x}}{2} \quad \text{ch}^2 x - \text{sh}^2 x = 1 \quad \text{sh} : \\
) h \quad S_n &= \frac{b_1(1-q^n)}{1-q} = \frac{b_1 - b_{n+1}}{1-q} \quad = a + a^2 b + 2a^2 b + ab^2 + 2ab^2 + b^3 \quad a_n = a_1 + (n-1)d \quad s(t+h) - s(t) = v(t) \\
 + h^2) - \frac{1}{2} g t^2 &= g t h + \frac{1}{2} g h^2 \quad S_n = \frac{2a_1 + (n-1)d}{2} n \quad s(t+h) - s(t) = \frac{1}{2} g (t+h)^2 - \frac{1}{2} g t^2 = \frac{1}{2} g (t^2 + 2th + h^2) \\
 t^2 &= g t \quad v(t) = g t \quad a_n = \frac{a_{n-1} + a_{n+1}}{2} \quad \frac{s(t+h) - s(t)}{h} \approx v(t) \quad v(t) = \lim_{h \rightarrow 0} \frac{\frac{1}{2} g (t+h)^2 - \frac{1}{2} g t^2}{h} \\
 \frac{s(t+h) - s(t)}{h} &= g t + \frac{1}{2} g h \quad a_n = \frac{a_{n-k} + a_{n+k}}{2}, n \geq k \quad \frac{s(t+h) - s(t)}{h} = g t + \frac{1}{2} g h \quad v(t) = \lim_{h \rightarrow 0} \frac{s(t+h) - s(t)}{h} \\
 e^{ix} &= \cos x + i \sin x \quad (\cos \varphi + i \sin \varphi)^n = \cos n\varphi + i \sin n\varphi \quad \frac{v(t+h) - v(t)}{h} = g \quad v(t+h) - v(t) = g(t+h) - g t
 \end{aligned}$$

Thank you!

$$\begin{aligned}
 &= 2px + \lambda x^2 \quad a = r \cos \varphi \quad b = r \sin \varphi \quad \arccos x = \frac{\sqrt{1-x^2}}{2} \arcsin x \quad y^2
 \end{aligned}$$