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$$\int_0^{\pi/2} (8+4\cos(2x))\,dx$$

$$f'(x) = 8x + 4\sin(2x) + C$$

$$\int_0^{\pi/2} (8+4\cos(2x))\,dx = \left(8\cdot\frac{\pi}{2} + 4\sin(90)\right) - \left(8\cdot 0 + 4\sin[0]\right)$$

$$= 4\pi + 4 - 0$$

$$= 4\pi + 4 = 16{,}56$$

- Single Trapezoinal Rule

$$I = \frac{\pi}{2}\left(\frac{(8+4\cos 90) + (8+4\cos 0)}{2}\right)$$

$$= \frac{\pi}{2}\left(\frac{8+8+4}{2}\right)$$

$$= \frac{20\pi}{4} = 5\pi = 15{,}7$$

$$E_t = 4\pi + 4 - 5\pi$$

$$= -\pi + 4$$

$$= 0{,}86$$

$$\text{Eror} = \frac{0{,}86}{16{,}56} \times 100\,\% = 5{,}19\,\%$$

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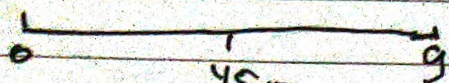
• multiple-application trapezoidal rule with n = 2 and 4



n = 2

$I = \pi/2 \left(\frac{12+2.10,8+8}{4}\right)$

$= \pi/2 \left(\frac{12+21,6+8}{4}\right)$

$= \frac{\pi}{2} \cdot 10,4$

$= 3,63$

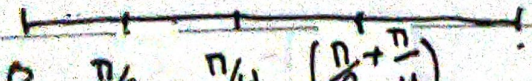
$f(0) = 8 + 4\cos 0$
$= 8 + 4$
$= 12$

$f(45) = 8 + 4\cos 45$
$= 8 + 4 \cdot \frac{1}{2}\sqrt{2}$
$= 8 + 2\sqrt{2}$
$= 10,8$

$f(90) = 8 + 4\cos 90$
$= 8 + 0$
$= 8$

$E_t = 16,56 - 3,63$
$= 12,93$

$\text{Error} = \frac{12,93}{16,56} \times 100\% = 78\%$



n = 4

$f(\frac{\pi}{8}+\frac{\pi}{4}) = 8 + 4\cos(\frac{\pi}{8}+\frac{\pi}{4})$
$= 9,53$

$f(\pi/2) = 8 + 4\cos(\pi/2)$
$= 8 + 0$
$= 8$

$f(0) = 8 + 4\cos 0$
$= 8 + 4$
$= 12$

$f(\pi/8) = 8 + 4\cos(\pi/8)$
$= 8 + 3,69$
$= 11,69$

$f(\pi/4) = 8 + 4\cos(\pi/4)$
$= 8 + 4 \cdot \frac{1}{2}\sqrt{2}$
$= 10,8$

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$$I = \pi/2 \left(\frac{12 + 2(11,69 + 10,8 + 9,53) + 8}{8} \right)$$

$$= \pi/2 \left(\frac{12 + 64,04 + 8}{8} \right)$$

$$= \pi/2 \cdot \frac{84,04}{8}$$

$$= 16,49$$

$$E_t = 16,56 - 16,49$$
$$= 0,07$$

$$\text{Error} = \frac{0,07}{16,56} \times 100\% = 0,42\%$$

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Single application of Simpson's 1/3 rule

$$I = \pi/2 \left(\frac{12 + 4 \cdot 10,8 + 8}{6}\right)$$

$$= \pi/2 \left(\frac{12 + 43,2 + 8}{6}\right)$$

$$= \pi/2 \left(\frac{63,2}{6}\right)$$

$$= 16,53$$

$f(0) = 8 + 4\cos(0)$
$= 8 + 4$
$= 12$

$f(\pi/4) = 8 + 4\cos(\pi/4)$
$= 8 + 4 \cdot \frac{1}{2}\sqrt{2}$
$= 10,8$

$f(\pi/2) = 8 + 4\cos(\pi/2)$
$= 8 + 0$
$= 8$

$E_t = 16,56 - 16,53$
$= 0,03$

$\text{Error} = \frac{0,03}{16,56} \times 100\% = 0,18\%$

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multi-application 1/3 simpson's rule with n = 4

$f(0) = 8 + 4\cos(0)$
$= 8 + 4$
$= 12$

$f(\pi/4) = 8 + 4\cos(\pi/4)$
$= 8 + 4 \cdot \frac{1}{2}\sqrt{2}$
$= 10,8$

$f(\pi/2) = 8 + 4\cos(\pi/2)$
$= 8 + 0$
$= 8$

$f(\pi/8) = 8 + 4\cos(\pi/8)$
$= 8 + 3,69$
$= 11,69$

$f(\pi/4 + \pi/8) = 8 + 4\cos(\pi/4 + \pi/8)$
$= 8 + 1,53$
$= 9,53$

$$I = \pi/2 \left(\frac{12 + 4(11,69 + 9,53) + 2(10,8) + 8}{12} \right)$$

$$= \pi/2 \left(\frac{12 + 84,88 + 21,6 + 8}{12} \right)$$

$$= \pi/2 \left(\frac{126,49}{12} \right)$$

$= 16,54$

$E_t = 16,56 - 16,54$
$= 0,02$

$\text{Error} = \frac{0,02}{16,56} = 0,12\%$