Integration

$$\int_0^1 \sqrt{1-x^2}\,dx$$

This is not your father's area?

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Ask me what I should already know

The pre-requisite questions

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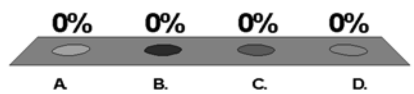
The exact mean value of the function *f(x)* from *a* to *b* is

A. $\dfrac{f(a)+f(b)}{2}$

B. $\dfrac{f(a)+2f\left(\dfrac{a+b}{2}\right)+f(b)}{4}$

C. $\int_a^b f(x)dx$

D. $\dfrac{\int_a^b f(x)dx}{(b-a)}$



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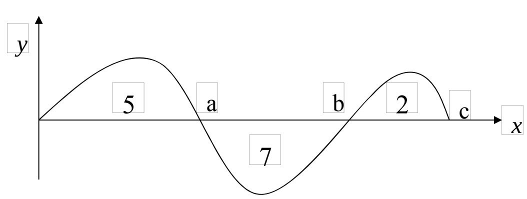
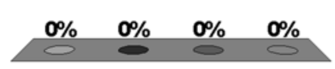
Given the *f(x)* vs *x* curve, and the magnitude of the areas as shown, the value of $\int_0^b f(x)dx$



A. -7
B. -2
C. 12
D. Cannot be determined



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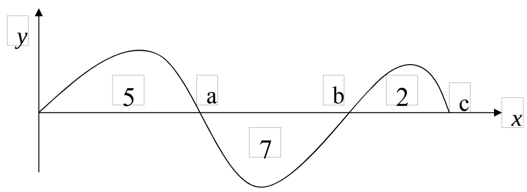
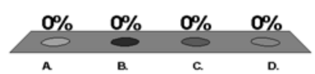
Given the $f(x)$ vs x curve, and the magnitude of the areas as shown, the value of $\int_a^b f(x)dx$



A. -7
B. -2
C. 7
D. 12



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PHYSICAL EXAMPLES

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Distance Covered By Rocket

$$x = \int_{t_0}^{t_1} \left[u \log_e \left(\frac{m_0}{m_0 - qt} \right) - gt \right] dt$$

$$x = \int_{8}^{30} \left(2000 \ln \left[\frac{140000}{140000 - 2100t} \right] - 9.8t \right) dt$$

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Concentration of Benzene

$$c(x,t) = \frac{c_0}{2} \left[erfc \left(\frac{x - ut}{2\sqrt{Dt}} \right) + e^{\frac{ux}{D}} erfc \left(\frac{x + ut}{2\sqrt{Dt}} \right) \right]$$

u= velocity of ground water flow in the *x* -direction (m/s)
D = dispersion coefficient (□m²)
C_0= initial concentration (kg/m³)

$$erfc(x) = \int_{\infty}^{x} e^{-z^2} dz$$

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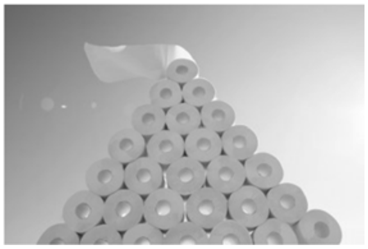
Is Wal*** "short shifting" you?

$$P(y \ge a) = \int_a^{\infty} f(y)dy = \int_a^{\infty} \frac{1}{\sigma\sqrt{2\pi}} e^{-(1/2)[(y-\mu)/\sigma]^2} dy$$



Roll	Number of sheets
1	253
2	250
3	251
4	252
5	253
6	253
7	252
8	254
9	252
10	252

$$P(y \ge 250) = \int_{250}^{\infty} 0.3515 \ e^{-0.3881(y-252.2)^2} dy$$

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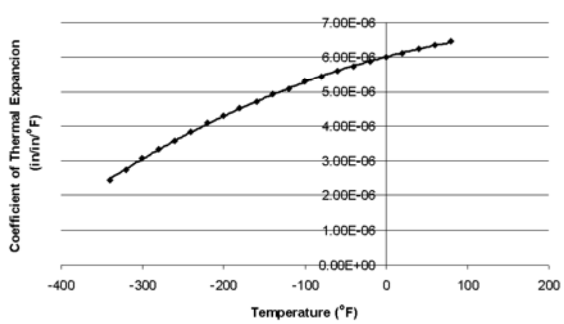
Calculating diameter contraction for trunnion-hub problem

$$\Delta D = D \int_{T_{room}}^{T_{fluid}} \alpha dT$$



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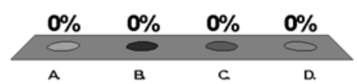
END

7.02
Trapezoidal Rule

Two-segment trapezoidal rule of integration is exact for integration of polynomials of order of at most

A. 1
B. 2
C. 3
D. 4



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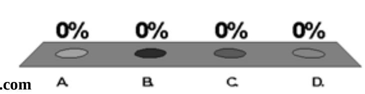
In trapezoidal rule, the number of segments needed to get the exact value for a general definite integral

A. 1
B. 2
C. 1 googol
D. infinite



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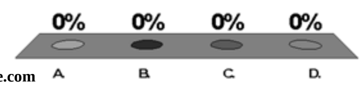
In trapezoidal rule, the number of points at which function is evaluated for 8 segments is

A. 8
B. 9
C. 16
D. 17



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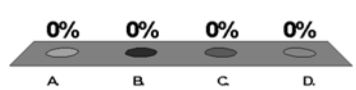
In trapezoidal rule, the number of function evaluations for 8 segments is

A. 8
B. 9
C. 16
D. 17



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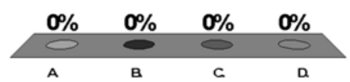
The distance covered by a rocket from t=8 to t=34 seconds is calculated using multiple segment trapezoidal rule by integrating a velocity function. Below is given the estimated distance for different number of segments, *n*.

n	1	2	3	4	5
Value	16520	15421	15212	15138	15104

The number of significant digits at least correct in the answer for *n*=5 is

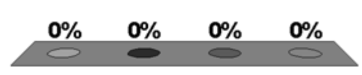
A. 1
B. 2
C. 3
D. 4



The velocity vs time is given below. A good estimate of the distance in meters covered by the body between t=0.5 and 1.2 seconds is

t(s)	0	0.5	1.2	1.5	1.8
v(m/s)	0	213	256	275	300

A. 213*0.7
B. 256*0.7
C. 256*1.2-213*0.5
D. ½*(213+256)*0.7



7.05
Gauss Quadrature Rule

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The morning after learning
Gauss Quadrature Rule…

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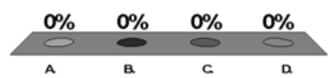
Autar Kaw is looking for a stage name. Please vote your choice.

A. The last mindbender
B. Ƙ (formerly known as Kaw)
C. Kid Cuddi
D. Kaw & Saki



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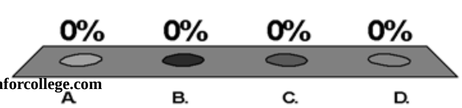
$\int_{5}^{10} f(x)dx$ is exactly

A. $\int_{-1}^{1} f(2.5x+7.5)dx$

B. $2.5\int_{-1}^{1} f(2.5x+7.5)dx$

C. $5\int_{-1}^{1} f(5x+5)dx$

D. $5\int_{-1}^{1} (2.5x+7.5)f(x)dx$



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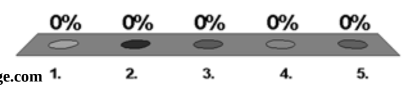
A scientist would derive one-point Gauss Quadrature Rule based on getting exact results of integration for function $f(x)=a_0+a_1x$. The one-point rule approximation for the integral $\int_a^b f(x)dx$ is

A. $\frac{b-a}{2}[f(a)+f(b)]$

B. $(b-a)f(\frac{a+b}{2})$

C. $\frac{b-a}{2}\left[f\left(\frac{b-a}{2}\left\{\frac{-1}{\sqrt{3}}\right\}+\frac{b+a}{2}\right)+f\left(\frac{b-a}{2}\left\{\frac{1}{\sqrt{3}}\right\}+\frac{b+a}{2}\right)\right]$

D. $(b-a)f(a)$



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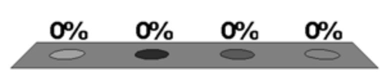
For integrating any first order polynomial, the one-point Gauss quadrature rule will give the same results as

A. 1-segment trapezoidal rule
B. 2-segment trapezoidal rule
C. 3-segment trapezoidal rule
D. All of the above



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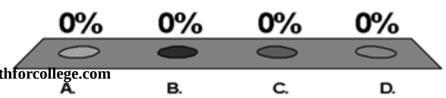
A scientist can derive a one-point quadrature rule for integrating definite integrals based on getting exact results of integration for the following function

A. $a_0+a_1x+a_2x^2$
B. $a_1x+a_2x^2$
C. a_1x
D. a_2x^2



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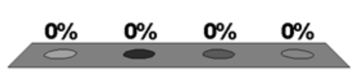
For integrating any third order polynomial, the two-point Gauss quadrature rule will give the same results as

A. 1-segment trapezoidal rule
B. 2-segment trapezoidal rule
C. 3-segment trapezoidal rule
D. None of the above



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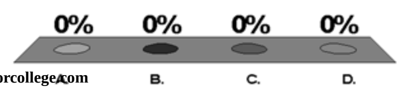
The highest order of polynomial for which the *n*-point Gauss-quadrature rule would give an exact integral is

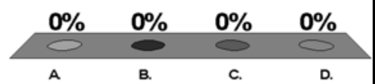
A. *n*
B. *n*+1
C. 2*n*-1
D. 2*n*



END

Physically, integrating $\int_a^b f(x)dx$ means finding the

A. Area under the curve from *a* to *b*
B. Area to the left of point *a*
C. Area to the right of point *b*
D. Area above the curve from *a* to *b*



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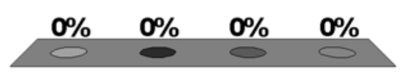
The velocity of a body is given as $v(t)=t^2$. Given that

$$\int_3^6 t^2 dt = 63$$

the location of the body at t=6 is

A. 27
B. 54
C. 63
D. Cannot be determined



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The velocity of a body is given as $v(t)=t^2$. Given that

$$\int_3^6 t^2 dt = 63$$

the distance covered by the body between t=3 and t=6 is

A. 27

B. 54

C. 63

D. Cannot be determined

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