6. $\frac{1}{2}\int e^{\frac{t}{2}}\,dt =$

(A) $e^{-t}+C$ (B) $e^{-\frac{t}{2}}+C$ (C) $e^{\frac{t}{2}}+C$ (D) $2e^{\frac{t}{2}}+C$ (E) $e^{t}+C$

90. Which of the following are antiderivatives of $f(x)=\sin x\cos x$?

I. $F(x)=\frac{\sin^2 x}{2}$

II. $F(x)=\frac{\cos^2 x}{2}$

III. $F(x)=\frac{-\cos(2x)}{4}$

(A) I only

(B) II only

(C) III only

(D) I and III only

(E) II and III only

6. C $\frac{1}{2}\int e^{\frac{t}{2}}\,dt = e^{\frac{t}{2}} + C$

90.	D	$F(x)=\frac{1}{2}\sin^2 x$	$F'(x)=\sin x\cos x$	Yes
		$F(x)=\frac{1}{2}\cos^2 x$	$F'(x)=-\cos x\sin x$	No
		$F(x)=-\frac{1}{4}\cos(2x)$	$F'(x)=\frac{1}{2}\sin(2x)=\sin x\cos x$	Yes

38. If the second derivative of f is given by $f''(x) = 2x - \cos x$, which of the following could be $f(x)$?

(A) $\frac{x^3}{3} + \cos x - x + 1$

(B) $\frac{x^3}{3} - \cos x - x + 1$

(C) $x^3 + \cos x - x + 1$

(D) $x^2 - \sin x + 1$

(E) $x^2 + \sin x + 1$

5. $\int \sec^2 x\, dx =$

(A) $\tan x + C$

(B) $\csc^2 x + C$

(C) $\cos^2 x + C$

(D) $\frac{\sec^3 x}{3} + C$

(E) $2\sec^2 x \tan x + C$

7. $\int \frac{x\, dx}{\sqrt{3x^2 + 5}} =$

(A) $\frac{1}{9}\left(3x^2 + 5\right)^{\frac{3}{2}} + C$

(B) $\frac{1}{4}\left(3x^2 + 5\right)^{\frac{3}{2}} + C$

(C) $\frac{1}{12}\left(3x^2 + 5\right)^{\frac{1}{2}} + C$

(D) $\frac{1}{3}\left(3x^2 + 5\right)^{\frac{1}{2}} + C$

(E) $\frac{3}{2}\left(3x^2 + 5\right)^{\frac{1}{2}} + C$

38. A $f'(x)=x^2-\sin x+C$, $f(x)=\frac{1}{3}x^3+\cos x+Cx+K$. Option A is the only one with this form.

5. A $\int \sec^2 x\,dx=\int d\left(\tan x\right)=\tan x+C$

7. D $\int x(3x^2+5)^{-\frac{1}{2}}dx=\frac{1}{6}\int (3x^2+5)^{-\frac{1}{2}}\left(6x\,dx\right)=\frac{1}{6}\cdot 2(3x^2+5)^{\frac{1}{2}}+C=\frac{1}{3}(3x^2+5)^{\frac{1}{2}}+C$

14. $\int \frac{3x^2}{\sqrt{x^3+1}}\,dx =$

(A) $2\sqrt{x^3+1}+C$

(B) $\frac{3}{2}\sqrt{x^3+1}+C$

(C) $\sqrt{x^3+1}+C$

(D) $\ln\sqrt{x^3+1}+C$

(E) $\ln(x^3+1)+C$

17. $\int (x^2+1)^2\,dx =$

(A) $\frac{(x^2+1)^3}{3}+C$

(B) $\frac{(x^2+1)^3}{6x}+C$

(C) $\left(\frac{x^3}{3}+x\right)^2+C$

(D) $\frac{2x(x^2+1)^3}{3}+C$

(E) $\frac{x^5}{5}+\frac{2x^3}{3}+x+C$

22. An antiderivative for $\frac{1}{x^2-2x+2}$ is

(A) $-(x^2-2x+2)^{-2}$

(B) $\ln(x^2-2x+2)$

(C) $\ln\left|\frac{x-2}{x+1}\right|$

(D) $\operatorname{arcsec}(x-1)$

(E) $\arctan(x-1)$

14. A Let $u = x^3 + 1$. Then $\int \frac{3x^2}{\sqrt{x^3+1}}\,dx = \int u^{-1/2}\,du = 2u^{1/2} + C = 2\sqrt{x^3+1} + C$

17. E Expand the integrand. $\int (x^2+1)^2\,dx = \int (x^4 + 2x^2 + 1)\,dx = \frac{1}{5}x^5 + \frac{2}{3}x^3 + x + C$

22. E $\int \frac{1}{x^2 - 2x + 2}\,dx = \int \frac{1}{(x^2 - 2x + 1) + 1}\,dx = \int \frac{1}{(x-1)^2 + 1}\,dx = \tan^{-1}(x-1) + C$

1. $\int \left(x^3 - 3x\right) dx =$

(A) $3x^2 - 3 + C$

(B) $4x^4 - 6x^2 + C$

(C) $\dfrac{x^4}{3} - 3x^2 + C$

(D) $\dfrac{x^4}{4} - 3x + C$

(E) $\dfrac{x^4}{4} - \dfrac{3x^2}{2} + C$

32. $\int \dfrac{5}{1+x^2}\, dx =$

(A) $\dfrac{-10x}{\left(1+x^2\right)^2} + C$

(B) $\dfrac{5}{2x}\ln\left(1+x^2\right) + C$

(C) $5x - \dfrac{5}{x} + C$

(D) $5\arctan x + C$

(E) $5\ln\left(1+x^2\right) + C$

20. $\int x\sqrt{4-x^2}\, dx =$

(A) $\dfrac{\left(4-x^2\right)^{3/2}}{3} + C$

(B) $-\left(4-x^2\right)^{3/2} + C$

(C) $\dfrac{x^2\left(4-x^2\right)^{3/2}}{3} + C$

(D) $-\dfrac{x^2\left(4-x^2\right)^{3/2}}{3} + C$

(E) $-\dfrac{\left(4-x^2\right)^{3/2}}{3} + C$

1. E $\int (x^3 - 3x)\,dx = \frac{1}{4}x^4 - \frac{3}{2}x^2 + C$

32. D $\int \frac{5}{1+x^2}\,dx = 5\int \frac{1}{1+x^2}\,dx = 5\tan^{-1}(x) + C$

20. E $\int x\sqrt{4-x^2}\,dx = -\frac{1}{2}\int \left(4-x^2\right)^{\frac{1}{2}}(-2x\,dx) = -\frac{1}{2}\cdot\frac{2}{3}\left(4-x^2\right)^{\frac{3}{2}} + C = -\frac{1}{3}\left(4-x^2\right)^{\frac{3}{2}} + C$

38. $\int \frac{x^2}{e^{x^3}}\,dx =$

(A) $-\frac{1}{3}\ln e^{x^3} + C$

(B) $-\frac{e^{x^3}}{3} + C$

(C) $-\frac{1}{3e^{x^3}} + C$

(D) $\frac{1}{3}\ln e^{x^3} + C$

(E) $\frac{x^3}{3e^{x^3}} + C$

43. $\int \sin(2x+3)\,dx =$

(A) $\frac{1}{2}\cos(2x+3) + C$

(B) $\cos(2x+3) + C$

(C) $-\cos(2x+3) + C$

(D) $-\frac{1}{2}\cos(2x+3) + C$

(E) $-\frac{1}{5}\cos(2x+3) + C$

30. $\int \tan(2x)\,dx =$

(A) $-2\ln|\cos(2x)| + C$

(B) $-\frac{1}{2}\ln|\cos(2x)| + C$

(C) $\frac{1}{2}\ln|\cos(2x)| + C$

(D) $2\ln|\cos(2x)| + C$

(E) $\frac{1}{2}\sec(2x)\tan(2x) + C$

38. C $\int \frac{x^2}{e^{x^3}}dx = -\frac{1}{3}\int e^{-x^3}(-3x^2dx) = -\frac{1}{3}e^{-x^3} + C = -\frac{1}{3e^{-x^3}} + C$

43. D $\int \sin(2x+3)\,dx = -\frac{1}{2}\cos(2x+3) + C$

30. B $\int \tan(2x)\,dx = -\frac{1}{2}\int \frac{-2\sin(2x)}{\cos(2x)}dx = -\frac{1}{2}\ln|\cos(2x)| + C$

8. $\int \cos(3 - 2x)\, dx =$

(A) $\sin(3 - 2x) + C$

(B) $-\sin(3 - 2x) + C$

(C) $\frac{1}{2}\sin(3 - 2x) + C$

(D) $-\frac{1}{2}\sin(3 - 2x) + C$

(E) $-\frac{1}{5}\sin(3 - 2x) + C$

No Calculator

10. For $0 \le x < \frac{\pi}{2}$, an antiderivative of $2\tan x$ is

(A) $\ln(\sec 2x)$

(B) $2\sec^2 x$

(C) $\ln(\sec^2 x)$

(D) $2\ln(\cos x)$

(E) $\ln(2\sec x)$

No Calculator

8. D p. 3

$$\int \cos(3-2x)\,dx = -\frac{1}{2}\int(-2)\cos(3-2x)\,dx$$
$$= -\frac{1}{2}\sin(3-2x) + C$$

10. When finding an antiderivative of $2\tan x$, we are integrating $2\tan x$,

$\int 2\tan x\,dx = 2\int \tan x\,dx = 2\ln|\sec x| = 2\ln(\sec x)$, since $0 \le x < \frac{\pi}{2}$.

Then rewrite the expression $2\ln(\sec x)$ as $\ln(\sec^2 x)$, since $\ln(a^b) = b\ln a$, so

$\ln(\sec^2 x) = 2\ln(\sec x)$.

Therefore, an antiderivative of $2\tan x$ is $\ln(\sec^2 x)$.

The correct choice is (C).

1. $\int e^{\cos x} \sin x \, dx =$

(A) $-e^{\cos(x)+1} + C$ (B) $e^{\cos x} + C$ (C) $-e^{\cos x} + C$

(D) $e^{\sin x} + C$ (E) $e^{\sin x} \cos(x) + C$

No Calculator

1. $\int \sin x^3 \, 3x^2 \, dx$

2. $\int \frac{5 \, dx}{4x + 3}$

No Calculator

1. (C) $u = \cos x$ and $du = -\sin x\, dx$; the original integral becomes $-\int e^u\, du$, which integrates to (C).

1. $u = x^3$ and $du = 3x^2\, dx$, substitution transforms the original integral to $\int u\, du$.

2. $u = 4x + 3$ and $du = 4\, dx$, substitution transforms the original integral to $\frac{5}{4}\int \frac{1}{u}\, du$.

No Calculator

3. $\int 7 \tan^5 x \sec^2 x \, dx$

4. $\int \frac{4x \, dx}{\sqrt{x^2 - 4}}$

No Calculator

5. $\int \csc x^2 \cdot \cot x^2 \cdot 8x \, dx$

6. $\int \frac{3^{\ln(x)}}{x} \, dx$

3. $u = \tan x$ and $du = \sec^2 x\,dx$, substitution transforms the original integral to $\int 7u^5\,du$.

4. $u = x^2 - 4$ and $du = 2x\,dx$, substitution transforms the original integral to $2\int u^{1/2}\,du$.

5. $u = x^2$ and $du = 2x\,dx$, substitution transforms the original integral to $4\int \csc u \cot u\,du$.

6. $u = \ln x$ and $du = \frac{1}{x}\,dx$, substitution transforms the original integral to $\int 3^u\,du$.