$$y = \ln x \to \ln(x-3)$$
$$\to \ln\left(\frac{1}{2}x - 3\right)$$

(a) $f(x) \in (0, \infty)$

(b) $g(x) \in (-\infty, -1] \cup [1, \infty)$

(a) $x \geq 0$, $f(x) \geq 0$

(b) $x > 0$, $g(x) \in \mathbb{R}$

(c) $x \neq 2$, $h(x) \neq 0$

(1) Reflection in the x-axis

(2) Translation $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$

or

(1) Translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$

(2) Reflection in the x-axis

$$y = \ln x \to \ln\left(\frac{1}{2}x\right)$$
$$\to \ln\left(\frac{1}{2}x - \frac{3}{2}\right)$$

(1) Translation $\begin{pmatrix} \frac{\pi}{3} \\ 0 \end{pmatrix}$

(2) Stretch, s.f. $\frac{1}{2}$, in x-direction

or

(1) Stretch, s.f. $\frac{1}{2}$, in x-direction

(2) Translation $\begin{pmatrix} \frac{\pi}{6} \\ 0 \end{pmatrix}$

(a) No (not one-one)

(b) No (not one-one)

(b) Yes

$$\frac{2}{x+1} + \frac{5}{x-2} - \frac{4}{(x-2)^2}$$

(1) Stretch, s.f. 2, in y-direction

(2) Translation $\begin{pmatrix} 0 \\ 5 \end{pmatrix}$

or

(1) Translation $\begin{pmatrix} 0 \\ \frac{5}{2} \end{pmatrix}$

(2) Stretch, s.f. 2, in y-direction

Technique

Domain and range of:

(a) $f(x) = \sqrt{x}$

(b) $g(x) = \ln x$

(c) $h(x) = \dfrac{1}{x-2}$

30s A2-B1

Technique

Range of

(a) $f(x) = e^x$

(b) $g(x) = \sec x$

using interval notation.

20s A2-B2

Technique

Translation $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$, followed by

stretch, s.f. 2 in x-direction

$y = \ln x \rightarrow \ldots$

30s A2-B3

Technique

Describe two different

sequences of transformations:

$y = \sin x \rightarrow \sin\left(2x - \dfrac{\pi}{3}\right)$

30s A2-B4

Technique

Stretch, s.f. 2 in x-direction

followed by translation $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$

$y = \ln x \rightarrow \ldots$

30s A2-B5

Technique

Describe two different

sequences of transformations:

$y = \cos x \rightarrow y = -\cos x + 2$

30s A2-B6

Technique

Describe two different

sequences of transformations:

$y = e^x \rightarrow y = 2e^x + 5$

30s A2-B7

Technique

Write the following in terms

of partial fractions:

$$\frac{7x^2 - 17x - 6}{(x+1)(x-2)^2}$$

2m 30s A2-B8

Technique

Determine which of the

following have an inverse:

(a) $y = \cos x, \quad 0° < x < 360°$

(b) $y = x^2, \quad x \in \mathbb{R}$

(c) $y = e^x, \quad x \in \mathbb{R}$

30s A2-B9

$$\sin x \equiv \sin(x \pm 2\pi)$$

$$\cos x \equiv \cos(x \pm 2\pi)$$

$$\tan x \equiv \tan(x \pm \pi)$$

$$\sin x = \sin(\pi - x)$$

$$\cos x = \cos(2\pi - x)$$

(alternative: $\cos x = \cos(-x)$)

	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$
sin	0	$1/2$	$1/\sqrt{2}$	$\sqrt{3}/2$	1
cos	1	$\sqrt{3}/2$	$1/\sqrt{2}$	$1/2$	0

Note: $\frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

$$\cos 2x \equiv \cos^2 x - \sin^2 x$$
$$\equiv 2\cos^2 x - 1$$
$$\equiv 1 - 2\sin^2 x$$

$$\sin 2x \equiv 2 \sin x \cos x$$

As $x \to 0$,

$$\sin x \approx x$$

$$\cos x \approx 1 - \frac{1}{2}x^2$$

$$\tan x \approx x$$

Deg	$30°$	$45°$	$60°$	$90°$	$180°$	$360°$
Rad	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$	π	2π

$$\sec x \equiv \frac{1}{\cos x}, \quad \operatorname{cosec} x \equiv \frac{1}{\sin x}$$

$$\cot x \equiv \frac{\cos x}{\sin x} \equiv \frac{1}{\tan x}$$

Except when $x = 0, \pi, \ldots$

$$\tan^2 x + 1 \equiv \sec^2 x$$

$$\cot^2 x + 1 \equiv \operatorname{cosec}^2 x$$

Key Fact

	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$
sin					
cos					

30s A2-E1

Key Fact

Symmetry properties for sin and cos (in radians)

15s A2-E2

Key Fact

Periodic properties for sin, cos and tan (in radians)

20s A2-E3

Key Fact

As $x \to 0$,

$\sin x \approx \ldots$

$\cos x \approx \ldots$

$\tan x \approx \ldots$

10s A2-E4

Key Fact

Double angle identity:

$\sin 2x \equiv \ldots$

5s A2-E5

Key Fact

Three double angle identities:

$\cos 2x \equiv \ldots$

10s A2-E6

Key Fact

2 identities linking

$\sec x$, $\operatorname{cosec} x$, $\cot x$ and $\tan x$

10s A2-E7

Key Fact

Fill in the gaps:

$$\sec x \equiv \frac{1}{\ldots} \quad , \quad \operatorname{cosec} x \equiv \frac{1}{\ldots}$$

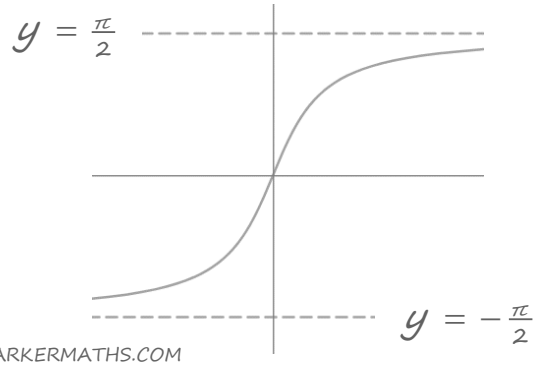
$$\cot x \equiv \frac{\ldots}{\ldots} \equiv \frac{1}{\ldots}$$

10s A2-E8

Key Fact

Deg	30°	45°	60°	90°	180°	360°
Rad						

25s A2-E9



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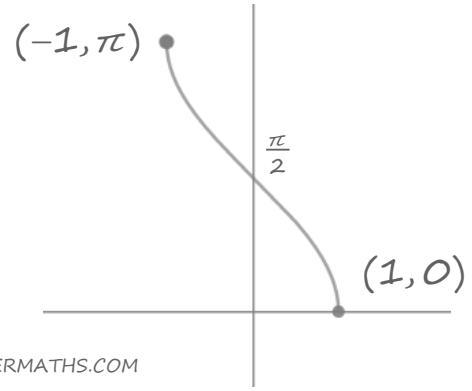

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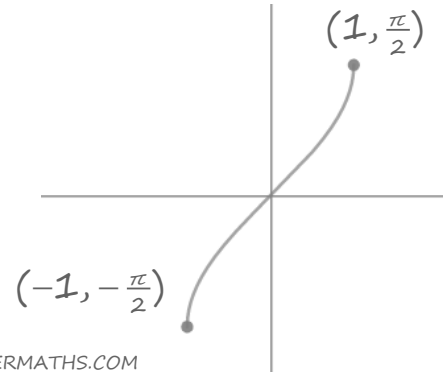

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In radians:

$$\text{Arc length} = r\theta$$

$$\text{Sector area} = \frac{1}{2}r^2\theta$$

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$$y = a \sin bx$$

$$\text{Amplitude} = a$$

$$\text{Period} = \frac{2\pi}{b}$$

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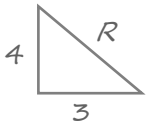
$$3\sin x - 4\cos x \equiv R\sin(x - \alpha)$$

$$\equiv R\sin x\cos\alpha - R\cos x\sin\alpha$$

$$3 = R\cos\alpha \qquad 4 = R\sin\alpha$$

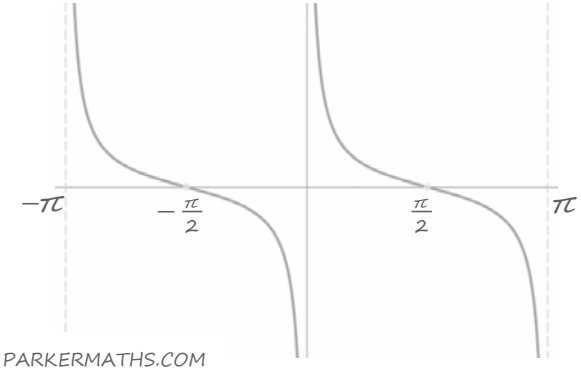
$$\cos\alpha = \frac{3}{R} \qquad \sin\alpha = \frac{4}{R}$$



$$R^2 = 3^2 + 4^2 \qquad \tan\alpha = \frac{4}{3}$$

$$R = 5 \qquad \alpha = 53.1°$$

$$3\sin x - 4\cos x = 5\sin(x - 53.1°)$$



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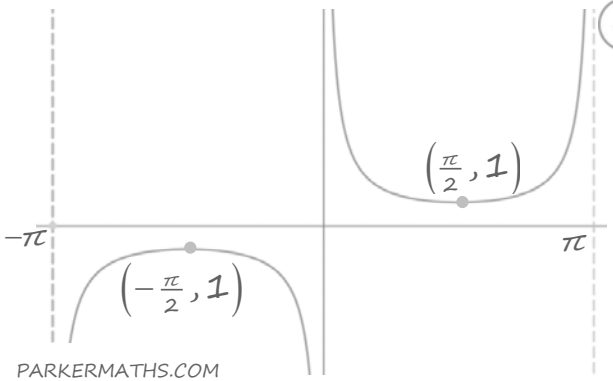

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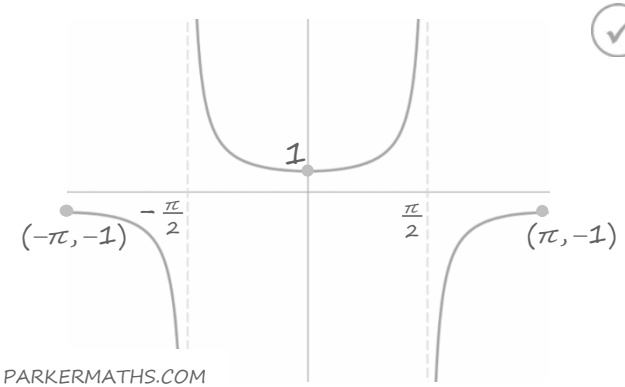

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Key Fact

Graph of $y = \sin^{-1} x$ in radians showing intercepts and endpoints.

30s A2-E10

Key Fact

Graph of $y = \cos^{-1} x$ in radians showing intercepts and endpoints.

30s A2-E11

Key Fact

Graph of $y = \tan^{-1} x$ in radians showing intercepts and asymptotes.

30s A2-E12

Technique

Given that

$3 \sin x - 4 \cos x = R \sin(x - \alpha)$

Find the values of R and α

2m A2-E13

Key Fact

In radians:

$y = a \sin bx$

Amplitude = ...

Period = ...

15s A2-E14

Key Fact

In radians:

Arc length = ...

Sector area = ...

10s A2-E15

Key Fact

Graph of $y = \sec x$, $-\pi \leq x \leq \pi$

Label asymptotes and stationary points.

60s A2-E16

Key Fact

Graph of $y = \text{cosec } x$

$-\pi \leq x \leq \pi$

(label asymptotes)

60s A2-E17

Key Fact

Graph of $y = \cot x$

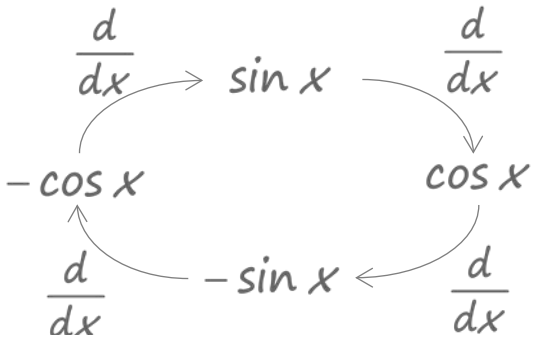
$-\pi \leq x \leq \pi$

(label asymptotes)

15s A2-E18

(a) $3e^{3x+5}$

(b) $(2x-6)e^{x^2-6x}$



(a) $\dfrac{2}{2x+1}$

(b) $\dfrac{2x-3}{x^2-3x}$

(c) $\dfrac{1}{x}$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$\frac{dy}{dx} = v\frac{du}{dx} + u\frac{dv}{dx}$$

(a) $-5\sin(5x-2)$

(b) $\dfrac{1}{3}\cos\left(\dfrac{1}{3}x+1\right)$

$$\frac{dy}{dx} = \frac{v\dfrac{du}{dx} - u\dfrac{dv}{dx}}{v^2}$$

(a) $2\cos 2x$

(b) $-3\sin 3x$

(a) $-30(3x-1)^{-6}$

(b) $2(4x+5)^{-\frac{1}{2}}$

Key Fact

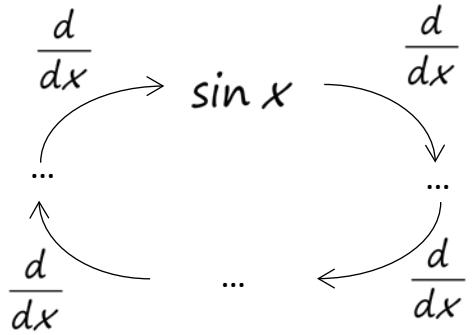
(a) $\frac{d}{dx}\ln(2x+1) = \ldots$

(b) $\frac{d}{dx}\ln(x^2-3x) = \ldots$

(c) $\frac{d}{dx}\ln(5x) = \ldots$

30s A2-G1

Key Fact



15s A2-G2

Key Fact

(a) $\frac{d}{dx}e^{3x+5} = \ldots$

(b) $\frac{d}{dx}e^{x^2-6x} = \ldots$

10s A2-G3

Key Fact

(a) $\frac{d}{dx}\cos(5x-2) = \ldots$

(b) $\frac{d}{dx}\sin\left(\frac{1}{3}x+1\right) = \ldots$

10s A2-G4

Key Fact

Product rule

for differentiation

10s A2-G5

Key Fact

Chain rule

for differentiation

5s A2-G6

Key Fact

(a) $\frac{d}{dx}\frac{2}{(3x-1)^5}$

(b) $\frac{d}{dx}\sqrt{4x+5}$

20s A2-G7

Key Fact

(a) $\frac{d}{dx}\sin 2x = \ldots$

(b) $\frac{d}{dx}\cos 3x = \ldots$

10s A2-G8

Key Fact

Quotient rule

for differentiation

10s A2-G9

(a) $\int \frac{3+2x}{x}\,dx = \int \left(\frac{3}{x}+2\right)dx$

$= 3\ln|x| + 2x + c$

(b) $\int \frac{6}{3+2x}\,dx = 3\ln|3+2x| + c$

(a) $\int \ldots dx = \int (2x+5)^{\frac{1}{2}}\,dx$

$= \frac{1}{3}(2x+5)^{\frac{3}{2}} + c$

(b) $\int \ldots dx = 3\int (4x+5)^{-\frac{1}{2}}\,dx$

$= \frac{3}{2}(4x+5)^{\frac{1}{2}} + c$

(a) $\frac{3}{2}\sin 2x + c$

(b) $-\frac{5}{3}\cos 3x + c$

(c) $-8\cos\left(\frac{1}{4}x\right) + c$

$\cos 6x = 1 - 2\sin^2 3x$

$\sin^2 3x = \frac{1}{2} - \frac{1}{2}\cos 6x$

$\int \sin^2 3x = \int \left(\frac{1}{2} - \frac{1}{2}\cos 6x\right)dx$

$= \frac{1}{2}x - \frac{1}{12}\sin 6x + c$

$\cos 2x = 2\cos^2 x - 1$

$\cos^2 x = \frac{1}{2}\cos 2x + \frac{1}{2}$

$\int \cos^2 x = \int \left(\frac{1}{2}\cos 2x + \frac{1}{2}\right)dx$

$= \frac{1}{4}\sin 2x + \frac{1}{2}x + c$

(a) $\int \ldots dx = 6\int (3+2x)^{-5}\,dx$

$= -\frac{3}{4}(3+2x)^{-4} + c$

(b) $\int \ldots dx = \int \left(9x^4 + 12x^3 + 4x^2\right)dx$

$= \frac{9}{5}x^5 + 3x^4 + \frac{4}{3}x^3 + c$

$\int_{x_1}^{x_2} y\,dx = \int_{t_1}^{t_2} y\frac{dx}{dt}\,dt$

(a) $\int \tan^2 x\,dx = \int \left(\sec^2 x - 1\right)dx$

$= \tan x - x + c$

(b) $\int \cot^2 x\,dx = \int (\operatorname{cosec}^2 x - 1)\,dx$

$= -\cot x - x + c$

(a) $\ldots = \frac{1}{2}x\sin 2x - \frac{1}{2}\int \sin 2x\,dx$

$= \frac{1}{2}x\sin 2x + \frac{1}{4}\cos 2x + c$

(b) $\ldots = \frac{1}{3}x^3\ln x - \int \frac{1}{3}x^2 dx$

$= \frac{1}{3}x^3\ln x - \frac{1}{9}x^3 + c$

Technique

(a) $\int 3\cos 2x\,dx = \ldots$

(b) $\int 5\sin 3x\,dx = \ldots$

(c) $\int 2\sin\left(\frac{1}{4}x\right)dx = \ldots$

25s A2-H1

Technique

(a) $\int \sqrt{2x+5}\,dx = \ldots$

(b) $\int \frac{3}{\sqrt{4x+5}}\,dx = \ldots$

30s A2-H2

Technique

(a) $\int \frac{3+2x}{x}\,dx = \ldots$

(b) $\int \frac{6}{3+2x}\,dx = \ldots$

30s A2-H3

Technique

(a) $\int \frac{6}{(3+2x)^5}\,dx = \ldots$

(b) $\int (3x^2+2x)^2\,dx = \ldots$

30s A2-H4

Technique

$\int \cos^2 x\,dx = \ldots$

60s A2-H5

Technique

$\int \sin^2 3x\,dx = \ldots$

60s A2-H6

Technique

(a) $\int x\cos 2x\,dx = \ldots$

(b) $\int x^2 \ln x\,dx = \ldots$

2m A2-H7

Technique

(a) $\int \tan^2 x\,dx = \ldots$

(b) $\int \cot^2 x\,dx = \ldots$

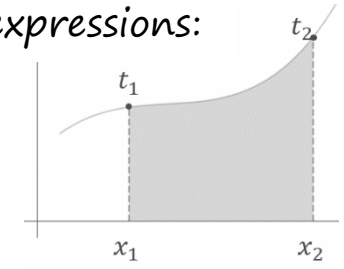
Tip: Identities and formula booklet.

60s A2-H8

Key Fact

Formula for integrating parametric expressions:

$\int_{x_1}^{x_2} y\,dx = \ldots$



15s A2-H9