QUESTION NUMBER

**11.(a)**

$$\int_{\frac{\pi}{2}}^{\pi} 5\sin x - 3\cos x \, dx$$

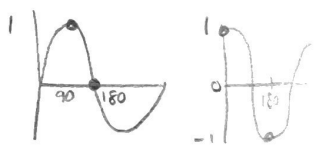
$$= \left[-5\cos x - 3\sin x\right]_{\pi/2}^{\pi}$$

$$= \left[-5\cos\pi - 3\sin\pi\right] - \left[-5\cos\tfrac{\pi}{2} - 3\sin\tfrac{\pi}{2}\right]$$

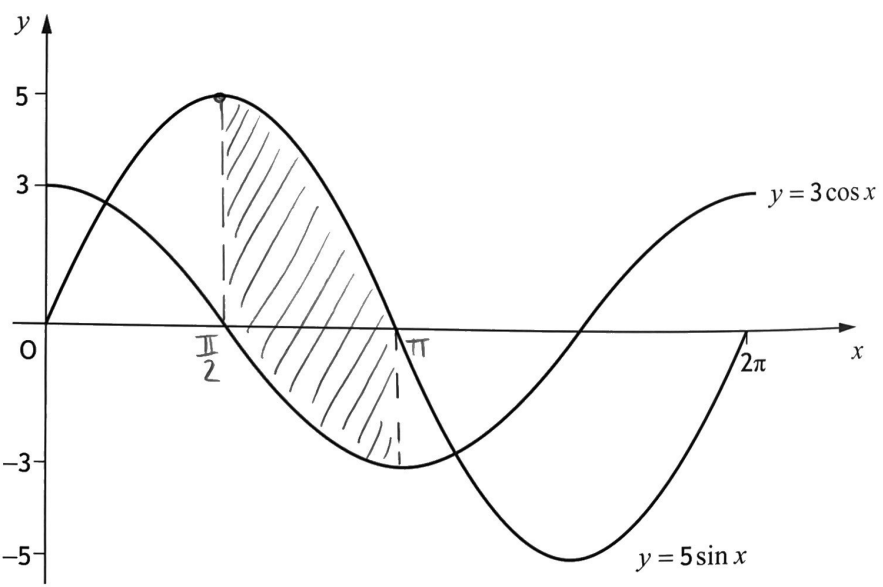
$$= \left[-(-5) - 0\right] - \left[0 - 3\right]$$

$$= 5 - (-3)$$

$$= 8$$




**11.(b)** An additional diagram, if required, can be found on *page 14*.




DO NOT WRITE IN THIS MARGIN

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **11.** | (a) | | $\bullet^1$ integrate<br><br>$\bullet^2$ substitute limits<br><br>$\bullet^3$ evaluate integral | $\bullet^1$ $-5\cos x - 3\sin x$<br><br>$\bullet^2$ $\left[-5\cos\pi - 3\sin\pi\right]$<br>$-\left[-5\cos\frac{\pi}{2} - 3\sin\frac{\pi}{2}\right]$<br><br>$\bullet^3$ 8 | **3** |

**Notes:**

1. Where candidates make no attempt to integrate or use another invalid approach award 0/3 - see Candidate A. However see also Candidates B to F.
2. Do not penalise the inclusion of '$+c$' or the continued appearance of the integral sign.
3. Candidates who change the limits to degrees before integrating cannot gain $\bullet^1$. However, $\bullet^2$ and $\bullet^3$ are still available.
4. $\bullet^3$ is only available where candidates have considered both limits within a trigonometric function.
5. The minimum acceptable response for $\bullet^2$ is $5-(-3)$.

**Commonly Observed Responses:**

**Candidate A - introducing a power**

Eg $5\sin x^2 - 3\cos x^2$ $\bullet^1$ × $\bullet^2$ × $\bullet^3$ ×

⋮

**Candidate B - differentiating in full**

$5\cos x + 3\sin x$ $\bullet^1$ ×

$\left(5\cos\pi + 3\sin\pi\right) - \left(5\cos\frac{\pi}{2} + 3\sin\frac{\pi}{2}\right)$ $\bullet^2$ ✓2

$-8$ $\bullet^3$ ✓1

**Candidate C - integrating one term**

$5\cos x - 3\sin x$ $\bullet^1$ ×

$\left(5\cos\pi - 3\sin\pi\right) - \left(5\cos\frac{\pi}{2} - 3\sin\frac{\pi}{2}\right)$ $\bullet^2$ ✓1

$-2$ $\bullet^3$ ✓1

**Candidate D - integrating one term**

$-5\cos x + 3\sin x$ $\bullet^1$ ×

$\left(-5\cos\pi + 3\sin\pi\right) - \left(-5\cos\frac{\pi}{2} + 3\sin\frac{\pi}{2}\right)$ $\bullet^2$ ✓1

$2$ $\bullet^3$ ✓1

**Candidate E - integrating one term**

Eg $5\sin x - 3\sin x$ $\bullet^1$ ×

$\left(5\sin\pi - 3\sin\pi\right) - \left(5\sin\frac{\pi}{2} - 3\sin\frac{\pi}{2}\right)$ $\bullet^2$ ✓1

$-2$ $\bullet^3$ ✓2

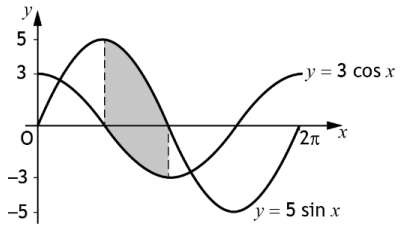
**Mark 3 is not of equivalent difficulty - only 2 exact values**

**Candidate F - obtaining other expressions of the form $a\sin x + b\cos x$**

Eg $-\frac{1}{5}\cos x - \frac{1}{3}\sin x$ $\bullet^1$ ×

$\left(-\frac{1}{5}\cos\pi - \frac{1}{3}\sin\pi\right) - \left(-\frac{1}{5}\cos\frac{\pi}{2} - \frac{1}{3}\sin\frac{\pi}{2}\right)$ $\bullet^2$ ✓2

$\frac{8}{15}$ $\bullet^3$ ✓1

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **11.** | (b) | | $\bullet^4$ identify boundaries and shade area | $\bullet^4$   | **1** |
| **Notes:** | | | | | |
| | | | | | |
| **Commonly Observed Responses:** | | | | | |
| | | | | | |