Integrate the following

1) $\sin(2x + 1)$
2) $3e^{2x}$
3) $4^{x+5}$
4) $\cos(1 - 2x)$
5) $\text{cosec}^2 3x$
6) $\sec 4x \tan 4x$
7) $3\sin(\frac{1}{2}x = 1)$
8) $\sec^2(2 - x)$
9) $\text{cosec} 2x \cot 2x$
10) $\cos 3x - \sin 3x$
11) $e^{2x} - \frac{1}{2}\sin(2x - 1)$
12) $(e^x + 1)^2$
13) $\sec^2 2x\,(1 + \sin 2x)$
14) $\frac{3 - 2\cos(\frac{1}{2}x)}{\sin^2 \frac{1}{2}x}$
15) $e^{3-x} + \sin(3 - x) + \cos(3 - x)$

(1) A curve $C$ has equation

$$y=\sqrt{x-3},\ x>3.$$

Find an equation of the normal to $C$ at the point where $x=7$

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(2) Differentiate each of the following expressions with respect to $x$, simplifying the final answers as far as possible

a) $y=\left(x^2-4\right)^3$

b) $y=x\cos 2x$

c) $y=\dfrac{\sin x}{x}$

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(3) A curve $C$ has equation

$$y=\sqrt{x^2+1},\ x\in\mathbb{R}.$$

Find an equation of the normal to $C$ at the point where $x=1$

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(4) A curve has equation

$$y=\frac{2x^2+3x}{2x^2-x-6}-\frac{6}{x^2-x-2},\ x\in\mathbb{R},\ 0<x<2.$$

a) Show clearly that

$$y=\frac{x+a}{x+1},\ x\in\mathbb{R},\ 0<x<2.$$ State a

b) Show further that the equation of the normal to the curve at the point where $x=1$ passes through $(0,p)$ State p

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(5) A curve has equation

$$y(y-1)=5x-3.$$

Find the gradient at each of the points on the curve where $x=3$.

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