Compute the following derivatives, using the standard differentiation rules. If there are places where the derivative is not defined, mention them.

1.

$$a(x) = 3x^2 - 6x - x^{-1}$$

$a(x)' = 6x^{2-1} - 6x^{1-1} + x^{-1-1}$ ← power rule

$\boxed{a(x)' =} \boxed{6x - 6 + x^{-2}}$ ✓

it is not defined when $x = 0$ ✓

2.

$$b(x) = \frac{\sin(x)}{\cos(x)}$$

$f = \sin(x) \quad g = \cos(x)$

$f' = \cos(x) \quad g' = -\sin(x)$

$$\frac{\cos(x)^2 - \sin(x)(-\sin(x))}{\cos(x)^2}$$

$$\frac{\cos(x)^2 + \sin(x)^2}{\cos(x)^2} = \frac{1}{\cos(x)^2} = \sec(x)^2$$

undefined where $\cos(x) = 0$

so at $\frac{\pi}{2}$, and $\frac{3\pi}{2}$, and so on.

good ✓

3.

$$c(x) = \underbrace{5e^x}_{f} \underbrace{\cos(x)}_{g}$$

Product Rule

$[f(x) \cdot g(x)]$

$\downarrow$

$\boxed{f(x)g'(x) + g(x)f'(x)}$

$f = 5e^x \qquad g = \cos x$

$f' = 5e^x \qquad g' = -\sin x$

$c'x = (5e^x)(-\sin x) + (5e^x)(\cos x)$

$c'x \rightarrow -5e^x(\sin x) + 5e^x(\cos x)$

$= 5e^x\left(\cos(x) - \sin(x)\right)$

factor when you can!

$$c(x) = 5e^x \cos(x)$$

product rule

$c'(x) = 5e^x(\cos x) + 5e^x(-\sin x)$

$= 5e^x(\cos x - \sin x)$

4.

$$d(x) = (3x-2)^2 = 9x^2 - 12x + 4$$

power rule → $d'(x) = 18x - 12$

or $d'(x) = 2(3x-2) \cdot 3$

(chain rule)

$= 6(3x-2)$ better – factor when you can.

$= \cancel{18x - 12}$