1. (**1**) Let $u = 9x^8 + 2$, so $y = u^2$.

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

$\frac{dy}{du} = 2 \times u^{2-1} = 2u^1 = 2u$

$\frac{du}{dx} = 9 \times 8 \times x^{8-1} = 72x^7$

So, $\frac{dy}{dx} = 2u \times 72x^7 = 2\left(9x^8 + 2\right) \times 72x^7 = 144x^7\left(9x^8 + 2\right)$.

Hence $\frac{dy}{dx} = 144x^7\left(9x^8 + 2\right)$.

(**2**) Let $u = 6 - 9x$, then $u' = -9$.
Let $v = 9 - 8x$, then $v' = -8$.
Quotient rule: $y' = \frac{u'v - uv'}{v^2}$, so

$$y' = \frac{-9 \times (9 - 8x) - (6 - 9x) \times (-8)}{(9 - 8x)^2} = \frac{-81 + 72x + 48 - 72x}{(9 - 8x)^2} = -\frac{33}{(9 - 8x)^2}.$$

Hence $y' = -\frac{33}{(9 - 8x)^2}$.

(**3**) Let $u = -2z^3 + 7$, then $u' = -6z^2$.
Let $v = -9 - 9z$, then $v' = -9$.
Product rule: $y' = u'v + uv'$.
Substitute u, u', v and v' into the product rule:

$$\begin{aligned} y' &= -6z^2 \times (-9 - 9z) + \left(-2z^3 + 7\right) \times (-9) \\ &= 54z^2 + 54z^3 + 18z^3 - 63 \end{aligned}$$

Hence $y' = 72z^3 + 54z^2 - 63$.

(**4**) Let $u = 4t^2 + 9$, then $u' = 8t$.
Let $v = -9t^2 + 5t$, then $v' = -18t + 5$.
Quotient rule: $y' = \frac{u'v - uv'}{v^2}$, so

$$\begin{aligned} y' &= \frac{8t \times \left(-9t^2 + 5t\right) - \left(4t^2 + 9\right) \times (-18t + 5)}{\left(-9t^2 + 5t\right)^2} \\ &= \frac{-72t^3 + 40t^2 - \left(-72t^3 + 20t^2 - 162t + 45\right)}{\left(-9t^2 + 5t\right)^2} \\ &= \frac{-72t^3 + 40t^2 + 72t^3 - 20t^2 + 162t - 45}{\left(-9t^2 + 5t\right)^2} \end{aligned}$$

Hence $y' = \frac{20t^2 + 162t - 45}{\left(-9t^2 + 5t\right)^2}$.

(**5**) Let $u = -5z - 4z^2 + 2$, then $u' = -5 - 8z$.
Let $v = -1 - 5z$, then $v' = -5$.
Quotient rule: $y' = \frac{u'v - uv'}{v^2}$, so

$$y' = \frac{(-5-8z)\times(-1-5z) - \left(-5z-4z^2+2\right)\times(-5)}{(-1-5z)^2}$$
$$= \frac{5+25z+8z+40z^2-25z-20z^2+10}{(-1-5z)^2}$$

Hence $y' = \dfrac{20z^2+8z+15}{(-1-5z)^2}$.

2. (**1**) Let $u = 3x^{-8}+6$, so $y = u^2$.

Now $\dfrac{dy}{dx} = \dfrac{dy}{du} \times \dfrac{du}{dx}$.

$\dfrac{dy}{du} = 2 \times u^{2-1} = 2u^1 = 2u$

$\dfrac{du}{dx} = 3 \times (-8) \times x^{-8-1} = -24x^{-9}$

So, $\dfrac{dy}{dx} = 2u \times \left(-24x^{-9}\right) = 2\left(3x^{-8}+6\right) \times \left(-24x^{-9}\right) = -48x^{-9}\left(3x^{-8}+6\right) = -\dfrac{48\left(3x^{-8}+6\right)}{x^9}$.

Hence $\dfrac{dy}{dx} = -\dfrac{48\left(3x^{-8}+6\right)}{x^9}$.

(**2**) Let $u = 6z-6$, then $u' = 6$.

Let $v = -9z-6$, then $v' = -9$.

Quotient rule: $y' = \dfrac{u'v-uv'}{v^2}$, so

$$y' = \frac{6\times(-9z-6)-(6z-6)\times(-9)}{(-9z-6)^2} = \frac{-54z-36+54z-54}{(-9z-6)^2} = -\frac{90}{(-9z-6)^2}.$$

Hence $y' = -\dfrac{90}{(-9z-6)^2}$.

(**3**) Let $u = -5-6t^3$, then $u' = -18t^2$.

Let $v = -6+t$, then $v' = 1$.

Product rule: $y' = u'v+uv'$.

Substitute u, u', v and v' into the product rule:

$$y' = -18t^2 \times (-6+t) + \left(-5-6t^3\right) \times 1$$
$$= 108t^2 - 18t^3 - 5 - 6t^3$$

Hence $y' = -24t^3 + 108t^2 - 5$.

(**4**) Let $u = -10z^2+z$, then $u' = -20z+1$.

Let $v = 7z^2+6z$, then $v' = 14z+6$.

Quotient rule: $y' = \dfrac{u'v-uv'}{v^2}$, so

$$y' = \frac{(-20z+1)\times\left(7z^2+6z\right) - \left(-10z^2+z\right)\times(14z+6)}{\left(7z^2+6z\right)^2}$$
$$= \frac{-140z^3-120z^2+7z^2+6z-\left(-140z^3-60z^2+14z^2+6z\right)}{\left(7z^2+6z\right)^2}$$
$$= \frac{-140z^3-120z^2+7z^2+6z+140z^3+60z^2-14z^2-6z}{\left(7z^2+6z\right)^2}$$

Hence $y' = \dfrac{-67z^2}{\left(7z^2+6z\right)^2}$.

(5) Let $u = -4z^2 - 9z - 3$, then $u' = -8z - 9$.
Let $v = -7z^2 + 5z + 3$, then $v' = -14z + 5$.
Quotient rule: $y' = \dfrac{u'v - uv'}{v^2}$, so

$$\begin{aligned} y' &= \frac{(-8z-9) \times \left(-7z^2+5z+3\right) - \left(-4z^2-9z-3\right) \times (-14z+5)}{\left(-7z^2+5z+3\right)^2} \\ &= \frac{56z^3 - 40z^2 - 24z + 63z^2 - 45z - 27 - 56z^3 + 20z^2 - 126z^2 + 45z - 42z + 15}{\left(-7z^2+5z+3\right)^2} \end{aligned}$$

Hence $y' = \dfrac{-83z^2 - 66z - 12}{\left(-7z^2+5z+3\right)^2}$.

3. **(1)** Let $u = -7 - 9x^4$, so $y = u^2$.
Now $\dfrac{dy}{dx} = \dfrac{dy}{du} \times \dfrac{du}{dx}$.

$\dfrac{dy}{du} = 2 \times u^{2-1} = 2u^1 = 2u$

$\dfrac{du}{dx} = -9 \times 4 \times x^{4-1} = -36x^3$

So, $\dfrac{dy}{dx} = 2u \times \left(-36x^3\right) = 2\left(-7-9x^4\right) \times \left(-36x^3\right) = -72x^3\left(-7-9x^4\right)$.

Hence $\dfrac{dy}{dx} = -72x^3\left(-7-9x^4\right)$.

(2) Let $u = -2x$, then $u' = -2$.
Let $v = -5x + 1$, then $v' = -5$.
Quotient rule: $y' = \dfrac{u'v - uv'}{v^2}$, so

$$y' = \frac{-2 \times (-5x+1) - (-2x \times (-5))}{(-5x+1)^2} = \frac{10x - 2 - 10x}{(-5x+1)^2} = -\frac{2}{(-5x+1)^2}.$$

Hence $y' = -\dfrac{2}{(-5x+1)^2}$.

(3) Let $u = -5 - 3h$, then $u' = -3$.
Let $v = -h + h^3$, then $v' = -1 + 3h^2$.
Product rule: $y' = u'v + uv'$.

Substitute u, u', v and v' into the product rule:

$$\begin{aligned} y' &= -3 \times \left(-h + h^3\right) + (-5-3h) \times \left(-1 + 3h^2\right) \\ &= 3h - 3h^3 + 5 - 15h^2 + 3h - 9h^3 \end{aligned}$$

Hence $y' = -12h^3 - 15h^2 + 6h + 5$.

(4) Let $u = 7x^2 + 5x$, then $u' = 14x + 5$.
Let $v = 7x^2 + 2$, then $v' = 14x$.
Quotient rule: $y' = \dfrac{u'v - uv'}{v^2}$, so

$$\begin{aligned} y' &= \frac{(14x+5) \times \left(7x^2+2\right) - \left(7x^2+5x\right) \times 14x}{\left(7x^2+2\right)^2} \\ &= \frac{98x^3 + 28x + 35x^2 + 10 - \left(98x^3 + 70x^2\right)}{\left(7x^2+2\right)^2} \\ &= \frac{98x^3 + 28x + 35x^2 + 10 - 98x^3 - 70x^2}{\left(7x^2+2\right)^2} \end{aligned}$$

Hence $y' = \dfrac{-35x^2+28x+10}{(7x^2+2)^2}$.

(5) Let $u=-1+8r-7r^2$, then $u'=8-14r$.
Let $v=-9r^2-6r$, then $v'=-18r-6$.
Quotient rule: $y' = \dfrac{u'v-uv'}{v^2}$, so

$$\begin{aligned} y' &= \frac{(8-14r)\times\left(-9r^2-6r\right)-\left(-1+8r-7r^2\right)\times(-18r-6)}{\left(-9r^2-6r\right)^2} \\ &= \frac{-72r^2-48r+126r^3+84r^2-18r-6+144r^2+48r-126r^3-42r^2}{\left(-9r^2-6r\right)^2} \end{aligned}$$

Hence $y' = \dfrac{114r^2-18r-6}{\left(-9r^2-6r\right)^2}$.

4. **(1)** Let $u=9-x^{-3}$, so $y=\dfrac{1}{u^3}=u^{-3}$.
Now $\dfrac{dy}{dx}=\dfrac{dy}{du}\times\dfrac{du}{dx}$.
$\dfrac{dy}{du}=-3\times u^{-3-1}=-3u^{-4}$
$\dfrac{du}{dx}=3\times x^{-3-1}=3x^{-4}$
So, $\dfrac{dy}{dx}=-3u^{-4}\times 3x^{-4}=-3\left(9-x^{-3}\right)^{-4}\times 3x^{-4}=-9x^{-4}\left(9-x^{-3}\right)^{-4}=-\dfrac{9}{x^4\left(9-x^{-3}\right)^4}$.

Hence $\dfrac{dy}{dx}=-\dfrac{9}{x^4\left(9-x^{-3}\right)^4}$.

(2) Let $u=3t+5$, then $u'=3$.
Let $v=8-t$, then $v'=-1$.
Quotient rule: $y' = \dfrac{u'v-uv'}{v^2}$, so
$y'=\dfrac{3\times(8-t)-(3t+5)\times(-1)}{(8-t)^2}=\dfrac{24-3t+3t+5}{(8-t)^2}=\dfrac{29}{(8-t)^2}$.
Hence $y'=\dfrac{29}{(8-t)^2}$.

(3) Let $u=4h^2-1$, then $u'=8h$.
Let $v=4h^3-2h^2$, then $v'=12h^2-4h$.
Product rule: $y'=u'v+uv'$.
Substitute u, u', v and v' into the product rule:

$$\begin{aligned} y' &= 8h\times\left(4h^3-2h^2\right)+\left(4h^2-1\right)\times\left(12h^2-4h\right) \\ &= 32h^4-16h^3+48h^4-16h^3-12h^2+4h \end{aligned}$$

Hence $y'=80h^4-32h^3-12h^2+4h$.

(4) Let $u=7h^2+3$, then $u'=14h$.
Let $v=4h^2+5$, then $v'=8h$.
Quotient rule: $y' = \dfrac{u'v-uv'}{v^2}$, so

$$
\begin{aligned}
y' &= \frac{14h \times \left(4h^2+5\right) - \left(7h^2+3\right) \times 8h}{\left(4h^2+5\right)^2} \\
&= \frac{56h^3 + 70h - \left(56h^3 + 24h\right)}{\left(4h^2+5\right)^2} \\
&= \frac{56h^3 + 70h - 56h^3 - 24h}{\left(4h^2+5\right)^2}
\end{aligned}
$$

Hence $y' = \dfrac{46h}{\left(4h^2+5\right)^2}$.

(5) Let $u = -3 + 2r$, then $u' = 2$.
Let $v = r + 6r^2 - 4$, then $v' = 1 + 12r$.
Quotient rule: $y' = \dfrac{u'v - uv'}{v^2}$, so

$$
\begin{aligned}
y' &= \frac{2 \times \left(r + 6r^2 - 4\right) - (-3 + 2r) \times (1 + 12r)}{\left(r + 6r^2 - 4\right)^2} \\
&= \frac{2r + 12r^2 - 8 + 3 + 36r - 2r - 24r^2}{\left(r + 6r^2 - 4\right)^2}
\end{aligned}
$$

Hence $y' = \dfrac{-12r^2 + 36r - 5}{\left(r + 6r^2 - 4\right)^2}$.

5. **(1)** Let $u = -4x^6 - 3$, so $y = u^5$.
Now $\dfrac{dy}{dx} = \dfrac{dy}{du} \times \dfrac{du}{dx}$.
$\dfrac{dy}{du} = 5 \times u^{5-1} = 5u^4$
$\dfrac{du}{dx} = -4 \times 6 \times x^{6-1} = -24x^5$
So, $\dfrac{dy}{dx} = 5u^4 \times \left(-24x^5\right) = 5\left(-4x^6 - 3\right)^4 \times \left(-24x^5\right) = -120x^5\left(-4x^6 - 3\right)^4$.

Hence $\dfrac{dy}{dx} = -120x^5\left(-4x^6 - 3\right)^4$.

(2) Let $u = 3 - 2r$, then $u' = -2$.
Let $v = 7 + 9r$, then $v' = 9$.
Quotient rule: $y' = \dfrac{u'v - uv'}{v^2}$, so
$y' = \dfrac{-2 \times (7 + 9r) - (3 - 2r) \times 9}{(7 + 9r)^2} = \dfrac{-14 - 18r - 27 + 18r}{(7 + 9r)^2} = -\dfrac{41}{(7 + 9r)^2}$.
Hence $y' = -\dfrac{41}{(7 + 9r)^2}$.

(3) Let $u = -2r + 10r^3$, then $u' = -2 + 30r^2$.
Let $v = -3r^2 + 4$, then $v' = -6r$.
Product rule: $y' = u'v + uv'$.
Substitute u, u', v and v' into the product rule:

$$
\begin{aligned}
y' &= \left(-2 + 30r^2\right) \times \left(-3r^2 + 4\right) + \left(-2r + 10r^3\right) \times (-6r) \\
&= 6r^2 - 8 - 90r^4 + 120r^2 + 12r^2 - 60r^4
\end{aligned}
$$

Hence $y' = -150r^4 + 138r^2 - 8$.

(**4**) Let $u = -6t^2 + 5t$, then $u' = -12t + 5$.
Let $v = -t^2 + 4$, then $v' = -2t$.
Quotient rule: $y' = \dfrac{u'v - uv'}{v^2}$, so

$$\begin{aligned} y' &= \frac{(-12t+5) \times \left(-t^2+4\right) - \left(-6t^2+5t\right) \times (-2t)}{\left(-t^2+4\right)^2} \\ &= \frac{12t^3 - 48t - 5t^2 + 20 - \left(12t^3 - 10t^2\right)}{\left(-t^2+4\right)^2} \\ &= \frac{12t^3 - 48t - 5t^2 + 20 - 12t^3 + 10t^2}{\left(-t^2+4\right)^2} \end{aligned}$$

Hence $y' = \dfrac{5t^2 - 48t + 20}{\left(-t^2+4\right)^2}$.

(**5**) Let $u = 7t + 7t^2 + 1$, then $u' = 7 + 14t$.
Let $v = -8t + 6t^2 - 3$, then $v' = -8 + 12t$.
Quotient rule: $y' = \dfrac{u'v - uv'}{v^2}$, so

$$\begin{aligned} y' &= \frac{(7+14t) \times \left(-8t+6t^2-3\right) - \left(7t+7t^2+1\right) \times (-8+12t)}{\left(-8t+6t^2-3\right)^2} \\ &= \frac{-56t + 42t^2 - 21 - 112t^2 + 84t^3 - 42t + 56t - 84t^2 + 56t^2 - 84t^3 + 8 - 12t}{\left(-8t+6t^2-3\right)^2} \end{aligned}$$

Hence $y' = \dfrac{-98t^2 - 54t - 13}{\left(-8t+6t^2-3\right)^2}$.