

## The Chain Rule

### Section A – straight forward

a)  $y = (3x + 2)^3$

c)  $y = (6 - 7x)^4$

e)  $y = \left(\frac{x}{3} + 1\right)^{12}$

b)  $y = (4x + 1)^5$

d)  $y = \left(\frac{1}{2}x - 2\right)^6$

f)  $y = \left(7 - \frac{x}{3}\right)^2$

### Section B – non-linear brackets

a)  $y = (3x^2 + 1)^2$

c)  $y = (4 - x^2)^5$

e)  $y = \left(\frac{1}{4}x^3 + \frac{1}{4}\right)^4$

b)  $y = (5x^2 - 2)^3$

d)  $y = \left(\frac{x^2}{2} + 1\right)^3$

f)  $y = \left(5 - \frac{x^3}{3}\right)^3$

### Section C – fractional and negative indices

a)  $y = (4x + 3)^{\frac{1}{2}}$

e)  $y = \sqrt{3x^2 + 4}$

b)  $y = (6x + 1)^{\frac{1}{3}}$

f)  $y = \sqrt[3]{5x^2 - 9}$

c)  $y = \sqrt{6x + 1}$

g)  $y = (x^2 + 3)^{-1}$

d)  $y = \sqrt[3]{5x + 2}$

h)  $y = \frac{1}{x^2 + 7}$

### Section D – fully factorised please

a)  $y = (3x^2 + 2x)^2$

e)  $y = \sqrt{x^2 + x + 1}$

b)  $y = (4x^2 - 3x)^3$

f)  $y = \frac{1}{4x^2 + 2x}$

c)  $y = (x^3 - x^2)^2$

g)  $y = \frac{1}{\sqrt{3x^2 + 1}}$

d)  $y = \sqrt{x^2 + 4x}$

h)  $y = \sqrt{(x + 4)(x - 3)}$

### Section E

Now you've cracked it, create some of your own.

## The Chain Rule - Answers

### Section A – straight forward

a)  $\frac{dy}{dx} = 9(3x + 2)^2$

c)  $\frac{dy}{dx} = -28(6 - 7x)^3$

e)  $\frac{dy}{dx} = 4\left(\frac{x}{3} + 1\right)^{11}$

b)  $\frac{dy}{dx} = 20(4x + 1)^4$

d)  $\frac{dy}{dx} = 3\left(\frac{1}{2}x - 2\right)^5$

f)  $\frac{dy}{dx} = -\frac{2}{3}\left(7 - \frac{x}{3}\right)$

### Section B – non-linear brackets

a)  $\frac{dy}{dx} = 12x(3x^2 + 1)$

c)  $\frac{dy}{dx} = -10x(4 - x^2)^4$

e)  $\frac{dy}{dx} = 3x^2\left(\frac{1}{4}x^3 + \frac{1}{4}\right)^3$

b)  $\frac{dy}{dx} = 30x(5x^2 - 2)^2$

d)  $\frac{dy}{dx} = 3x\left(\frac{x^2}{2} + 1\right)^2$

f)  $\frac{dy}{dx} = -3x^2\left(5 - \frac{x^3}{3}\right)^2$

### Section C – fractional and negative indices

a)  $\frac{dy}{dx} = 2(4x + 3)^{-\frac{1}{2}}$

e)  $\frac{dy}{dx} = \frac{3x}{\sqrt{3x^2+4}}$

b)  $\frac{dy}{dx} = 2(6x + 1)^{-\frac{2}{3}}$

f)  $\frac{dy}{dx} = \frac{10x}{3(\sqrt[3]{5x^2-9})^2}$

c)  $\frac{dy}{dx} = \frac{3}{\sqrt{6x+1}}$

g)  $\frac{dy}{dx} = -2x(x^2 + 3)^{-2}$

d)  $\frac{dy}{dx} = \frac{5}{3(\sqrt[3]{5x+2})^2}$

h)  $\frac{dy}{dx} = \frac{-2x}{(x^2+7)^2}$

### Section D – fully factorised please

a)  $\frac{dy}{dx} = 4x(3x + 1)(3x^2 + 2x)$

e)  $\frac{dy}{dx} = \frac{2x+1}{2\sqrt{x^2+x+1}}$

b)  $\frac{dy}{dx} = 3x^2(8x - 3)(4x^2 - 3x)^2$

f)  $\frac{dy}{dx} = \frac{-(4x+1)}{2x^2(2x+1)^2}$

c)  $\frac{dy}{dx} = 2x^3(x - 1)(3x - 2)$

g)  $\frac{dy}{dx} = \frac{-6x}{2(\sqrt{3x^2+1})^3}$

d)  $\frac{dy}{dx} = \frac{x+2}{\sqrt{x^2+4x}}$

h)  $\frac{dy}{dx} = \frac{(2x+1)}{2\sqrt{(x+4)(x-3)}}$

### Section E

Now you've cracked it, create some of your own.