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= Year 12   **= Calculus II**   **= Worksheet 2**

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1. Given $\dfrac{dp}{dr} = 3$ and $q = 4\sin^{-1}(p-1)+1$, find $\dfrac{dq}{dr}$ when $q = 1$.

2. Given $\dfrac{dr}{d\theta} = -2\theta$ and $\dfrac{dR}{d\theta} = \theta$, find $\dfrac{dR}{dr}$ when $\theta = \dfrac{\pi}{2}$.

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3. If $\dfrac{dy}{dx} = \dfrac{4}{4+x^2}$ and $\dfrac{dy}{dt} = 2$, find $\dfrac{dt}{dx}$ in terms of x.

4. Evaluate $\dfrac{dx}{dt}$ when $y = \log_e|x-1|$, $\dfrac{dy}{dt} = -1$ and $x = 0$

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5. The volume of water in a container is given by $V = \dfrac{1}{3}\pi h^3$ m³ when the depth is h m. Water is drained from the container at a constant rate of $\dfrac{\pi}{2}$ m³s⁻¹. Find the rate of decrease in the depth of water when $h = \dfrac{1}{\sqrt{2}}$.

6. The profile of a skate ramp is given by $y = 3\cos^{-1}\left(\dfrac{x}{5}-1\right)$. Find $\dfrac{dx}{dt}$ when $\dfrac{dy}{dt} = -2$ at $x = 2$. (Length in m, time in s)

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7. Given $\dfrac{(x-1)^2}{5} - y^2 = 1$, find $\dfrac{dy}{dx}$ at $x = 6$.

8. Refer to Q7. Find $\dfrac{dy}{dt}$ at $x = 6$ when $\dfrac{dx}{dt} = -2$.

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9. Given $3(x+1)y^2 = x+y+1$, find $\dfrac{dx}{dy}$ in terms of x and y.

10. Use calculus to find the coordinates of the points where the graph of $4x^2 + y^2 = 4(2x-y-1)$ has a vertical or horizontal tangent line.

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11. Refer to Q10. Find the exact coordinates of the points where the graph of $4x^2 + y^2 = 4(2x-y-1)$ has a gradient of 1.

Numerical, algebraic and worded answers.

1. 12
2. −1/2
3. 2 / (4+x²)
4. 1
5. 1 ms⁻¹
6. 8/3 ms⁻¹
7. ±1/2
8. ±1
9. (6xy+6y−1) / (1−3y²)
10. Hori: (1,0), (1,−4)
    Vert: (0,−2), (2,−2)
11. (1+1/√5, −2−4/√5)
    (1−1/√5, −2+4/√5)

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