

**Question 1:** Find the following derivatives (it is not necessary to simplify your answers, but marks will be deducted for improper use of notation):

(a)  $f(x) = 5(1 + x + x^2)^3$

[2]

(b)  $y = \sin(\pi t^3)$

[2]

(c)  $g(x) = \frac{\tan(e^x)}{7}$

[3]

(d)  $y = \sqrt{2x - \ln(x)}$

[3]

**Question 2:** Find the following derivatives (it is not necessary to simplify your answers, but marks will be deducted for improper use of notation):

(a)  $f(x) = \csc(\sqrt{1+x^2})$

[3]

(b)  $y = \cos^2(e^{\pi t})$

[2]

(c)  $g(x) = \frac{(1-x^2)^5}{(1+\sin(x))^2}$

[3]

(d)  $y = 2^{\sqrt{x}} \log_2(x)$

[2]

**Question 3:** Determine the equation of the tangent line to the curve

$$x^2y^2 - 2 = 2 \cos(\pi y)$$

at the point  $(x, y) = (1, 2)$ .

[5]

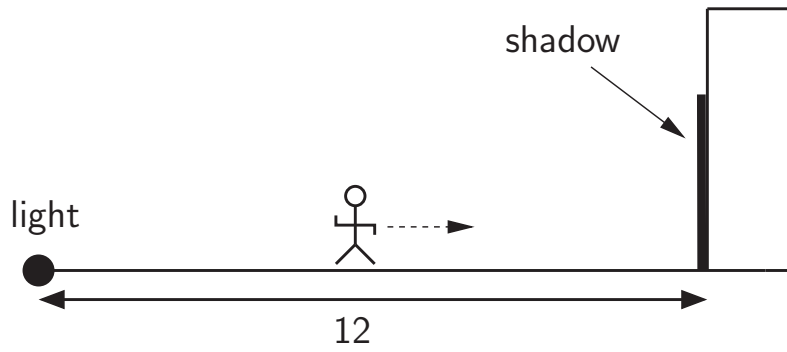
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**Question 4:** Use a linear approximation (or differentials) to estimate the value of  $(0.9)^7$ .

[5]

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**Question 5:** A spotlight on the ground shines on a wall 12 m away and a man 2 m tall walks from the spotlight to the building at a speed of  $1/2$  m/s. How fast is the length of the man's shadow on the building decreasing when he is 6 m from the building?



**Question 6:** Find  $y'$  where  $y = (1 + x)^{1/x}$  (logarithmic differentiation may help here.)

[5]

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**Question 7:** The graph of the exponential function  $f(x) = Ca^x$  passes through the points  $(1, 6)$  and  $(3, 24)$ . Determine the values of the constants  $a$  and  $C$ .

[5]

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