AQA IGCSE FM "Full Coverage": Differentiation

This worksheet is designed to cover one question of each type seen in past papers, for each AQA IGCSE Further Maths topic. This worksheet was automatically generated by the DrFrostMaths Homework Platform: students can practice this set of questions interactively by going to www.drfrostmaths.com/homework, logging on, *Practise → Past Papers/Worksheets* (or *Library → Past/Past Papers* for teachers), and using the 'Revision' tab.

Question 1

Categorisation: Understand that substituting a value of x into $\frac{dy}{dx}$ obtains the gradient of a curve at a particular point.

[AQA IGCSE FM Practice paper set 3 P2 Q3a]

A curve has gradient function $\frac{dy}{dx} = 2x^2 - 7$

Work out the gradient of the curve when $x = -3$

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Question 2

Categorisation: Find the value of x that results in a particular gradient, with a given gradient function.

[AQA IGCSE FM Practice paper set 3 P2 Q3b]

A curve has gradient function $\frac{dy}{dx} = 2x^2 - 7$

Work out the values of x for which the rate of change of y with respect to x is 1.

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Question 3

Categorisation: Determine the gradient function $\frac{dy}{dx}$ given y.

[AQA IGCSE FM Practice paper set 2 P2 Q12c]

A curve has equation $y = x^3 - 9x^2 + 24x - 16$

Work out $\frac{dy}{dx}$.

$\frac{dy}{dx} =$ .....

Question 4

Categorisation: Determine a gradient function requiring prior expansion.

[AQA IGCSE FM Practice paper set 3 P2 Q13]

$$y = x^{\frac{1}{2}}\left(x^{\frac{7}{2}} - x^{\frac{1}{2}}\right)$$

Work out $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

Question 5

Categorisation: Determine a gradient function requiring prior division.

[AQA IGCSE FM Practice paper set 4 P1 Q6]

$$y = \frac{3x(2x^4 - 5x)}{x^2}$$

Work out $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

Question 6

Categorisation: Determine the output for a function given an input.

[AQA IGCSE FM June2014-P2 Q4b]

A curve has equation $y = x^2(x - 2)$

Work out the gradient of the curve at the point $(3,9)$

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Question 7

Categorisation: Determine the value of a constant within a gradient function, given the gradient for a particular value of x.

[AQA IGCSE FM June2016-P2 Q6]

For the curve $y = f(x)$,

$$\frac{dy}{dx} = \frac{3}{2}x - kx^4 + k$$

where k is a constant.

When $x = -2$ the gradient of the curve is 12.
Work out the value of k .

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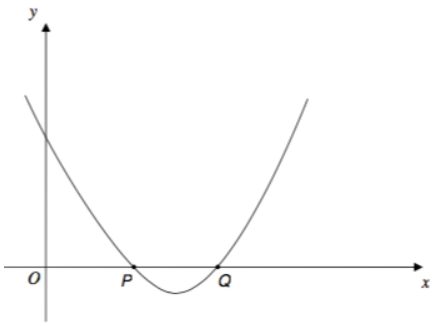
Question 8

Categorisation: Understand that "the gradient of a curve" at a given point is the same as "the gradient of the tangent to a curve" at that point.

[AQA IGCSE FM Practice paper set 2 P1 Q15 Edited]

The graph shows a sketch of $y = (x - 2)(x - 3)$

The curve intersects the x -axis at P and Q.



Find the gradient of the tangents to the curve at P and Q.

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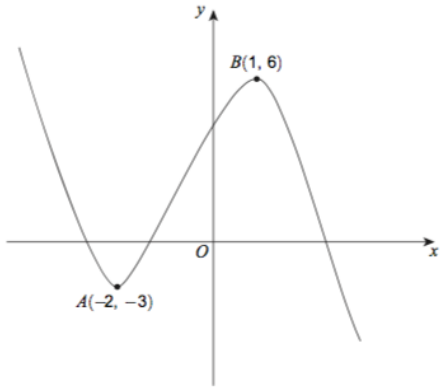
Question 9

Categorisation: Give the equation of a tangent at a stationary point.

[AQA IGCSE FM June2013-P2 Q8a]

A sketch of $y = f(x)$ is shown.

There are stationary points at A and B.



Write down the equation of the tangent to the curve at A.

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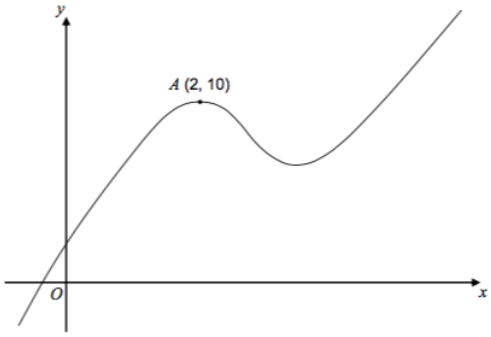
Question 10

Categorisation: Give the equation of the normal to a curve at a stationary point.

[AQA IGCSE FM Practice paper set 4 P2 Q22b]

A sketch of $y = f(x)$ where $f(x)$ is a cubic function, is shown.



There is a maximum point at A (2,10).

Write down the equation of the normal to the curve at A.

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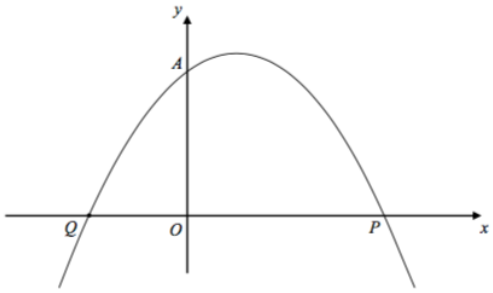
Question 11

Categorisation: Determine the equation of the normal to a curve at a given point.

[AQA IGCSE FM Practice paper set 4 P2 Q20b]

A sketch of the curve $y = (x + 1)(2 - x)$ is shown.

A(0, 2), P(2, 0) and Q are points on the curve.



Find an equation of the normal of the curve at A .

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Question 12

Categorisation: As above.

[AQA IGCSE FM Jan2013-P2 Q21] Work out the equation of the normal to the curve $y = x^2 + 4x + 5$ at the point where $x = -3$

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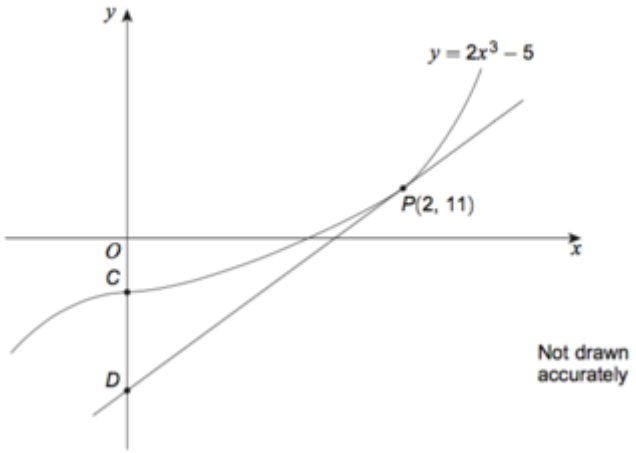
Question 13

Categorisation: Determine the tangent to a curve, and use in subsequent coordinate geometry, e.g. intersection of a tangent with the axes or determining a length.

[AQA IGCSE FM June2016-P2 Q25]

The curve $y = 2x^3 - 5$ intersects the y -axis at C.

The tangent to the curve at $P(2,11)$ intersects the y -axis at D.



Work out the length CD.

$CD =$ ..... units

Question 14

Categorisation: Determine the stationary point(s) of a curve.

[AQA IGCSE FM Practice paper set 1 P2 Q14a]

Work out the stationary points on the curve $y = x^3 - 12x$

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Question 15

Categorisation: Determine the nature of stationary points.

[AQA IGCSE FM Practice paper set 3 P1 Q16]

A curve has equation $y = 4x^3 + 6x^2 + 3x + 5$

Work out the coordinates of any stationary points on this curve and determine their nature.

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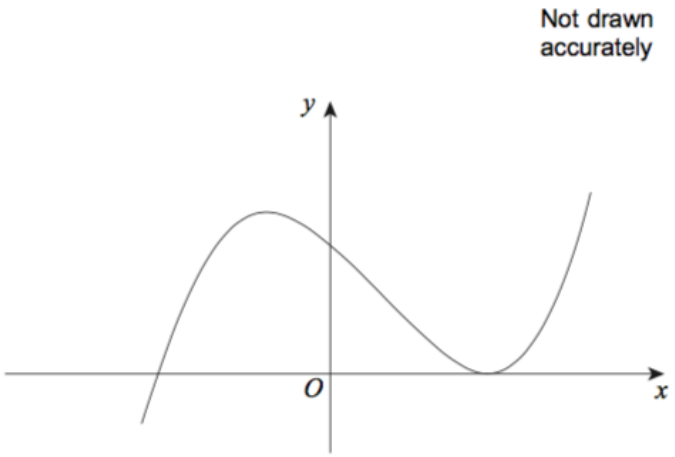
Question 16

Categorisation: Realise that when a stationary point is also a root/x-intercept, the y-value of the stationary point is 0.

[AQA IGCSE FM June2016-P1 Q17]

The diagram shows a sketch of the cubic curve $y = \frac{1}{3}x^3 - x^2 - 3x + k$ where k is a constant. The x-axis is a tangent to the curve at its minimum point.



Work out the value of k.

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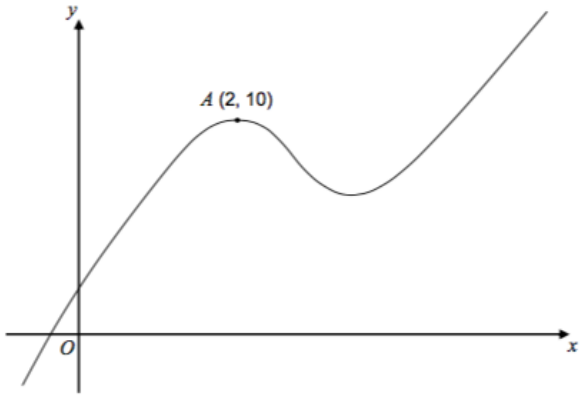
Question 17

Categorisation: Use information about a stationary point to determine the value of constants in an equation.

[AQA IGCSE FM Practice paper set 4 P2 Q22d]

A sketch of $y = f(x)$ where $f(x)$ is a cubic function, is shown.



There is a maximum point at A (2,10).

The equation of the curve is $y = px^3 - 3x^2 + 8x + r$ where p and r are constants.

Use the fact that there is a maximum point at (2, 10) to work out the values p and r .

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Question 18

Categorisation: Understand properties of an inflection point.

[AQA IGCSE FM June2015-P2 Q23]

The continuous curve $y = f(x)$ has exactly **two** stationary points.

P is a maximum point when $x = a$

Q is a stationary point of inflection when $x = b$

$$a < b$$

Which of these is correct?

When $a < x < b$, $\frac{dy}{dx}$ is positive **and** when $x > b$, $\frac{dy}{dx}$ is positive — A

When $a < x < b$, $\frac{dy}{dx}$ is positive **and** when $x > b$, $\frac{dy}{dx}$ is negative — B

When $a < x < b$, $\frac{dy}{dx}$ is negative **and** when $x > b$, $\frac{dy}{dx}$ is positive — C

When $a < x < b$, $\frac{dy}{dx}$ is negative **and** when $x > b$, $\frac{dy}{dx}$ is negative — D

[ ] A

[ ] B

[ ] C

[ ] D

Question 19

Categorisation: See Question 17.

[AQA IGCSE FM June2013-P2 Q18]

The curve $y = x^3 + bx + c$ has a stationary point at $(-2,20)$.
Work out the values of b and c.

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Question 20

Categorisation: Determine the range of values for which a function is increasing/decreasing.

[AQA IGCSE FM June2012-P2 Q20]

For what values of x is $y = 150x - 2x^3$ an increasing function?

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Question 21

Categorisation: Prove that a curve is an increasing/decreasing function for all x.

[AQA IGCSE FM Practice paper set 4 P1 Q10 Edited]

$y = 10 - 8x - x^3$ for all values of x.

Show that y is a decreasing function for all values x.

Answers

Question 1

11

Question 2

$x = 2$ or $x = -2$

Question 3

$\frac{dy}{dx} = 3x^2 - 18x + 24$

Question 4

$\frac{dy}{dx} = 4x^3 - 1$

Question 5

$\frac{dy}{dx} = 18x^2$

Question 6

15

Question 7

$k = -1$

Question 8

$m_P = -1$, $m_Q = 1$

Question 9

$y = -3$

Question 10

$x = 10$

Question 11

$y = -x + 2$

Question 12

$y - 2 = \frac{1}{2}(x + 3)$

Question 13

$CD =$ 32 units

Question 14

$x = 2$, $y = -16$ or $x = -2$, $y = 16$

Question 15

(-0.5, 4.5) , point of inflection

Question 16

$k = 9$

Question 17

$p = \frac{1}{3}$, $r = \frac{10}{3}$

Question 18

D

Question 19

$b = -12$, $c = 4$

Question 20

$-5 < x < 5$

Question 21

$\frac{dy}{dx} = -8 - 3x^2$

Since $x^2 \geq 0$ for all x, then $\frac{dy}{dx} < -8 < 0$ for all x.