

Course Methods Year 12 test two 2022

Student name: _____ Teacher name: _____

Task type: Response

Time allowed for this task: 40 mins

Number of questions: 7

Materials required: Upto 3 calculators/classpads allowed

Standard items: Pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: Drawing instruments, templates, one page of A4 notes doubled

Marks available: 40 marks

Task weighting: 10 %

Formula sheet provided: Yes

Note: All part questions worth more than 2 marks require working to obtain full marks.

Q1 (2 & 2 = 4 marks) (3.2.1)

Let $f'(x) = 6x^3 + 1$,a) Determine an expression for the rate of change of $f'(x)$.b) Determine $f(x)$ given that $f(3) = 1$.

Q2 (3 marks) (3.2.3-3.2.9)

Determine x in terms of t given that $\frac{dx}{dt} = \frac{-5}{(3t+5)^3}$ and $x = 10$ when $t = 1$.

Q3 (4 marks) (3.2.21-3.2.22)

A particle travels along a straight line such that its acceleration at time t seconds is equal to $(3t^2 + 2t + 1) \text{ m/s}^2$. When $t = 0$ the displacement is 10 metres and when $t = 2$ the displacement is 20 metres. Determine the displacement when $t = 3$.

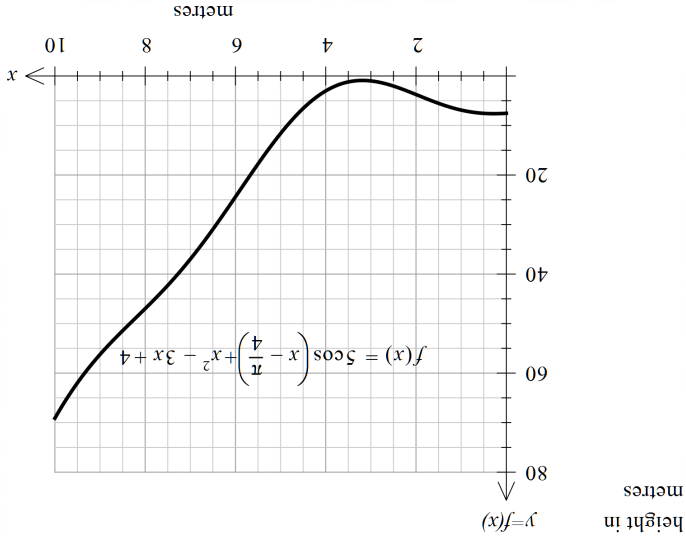
Q7 continued

c) A water collection tank will be placed at the **steepest** part of the mountain. Determine the coordinates of this point to 2 decimal places. Justify.

Q7 (1, 3 & 4 = 8 marks) (3.2.5-3.1.6)

The cross section of a mountain can be given by $f(x) = 5\cos\left(x - \frac{\pi}{4}\right) + x^2 - 3x + 4$ for $0 \leq x \leq 10$ metres where $f(x)$ = height at x metres.

cross-section of a mountain



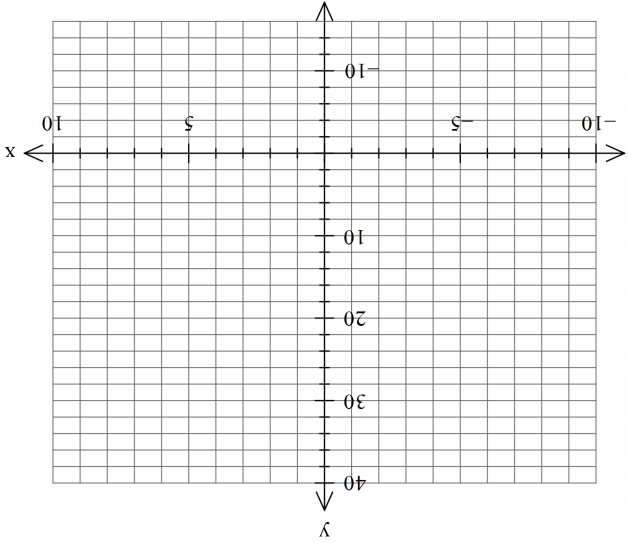
a) Determine $\frac{dy}{dx}$.

b) Determine the minimum height of the mountain to 2 decimal places. Justify.

Q4 (6 marks) (3.2.19-3.2.20)

Make a sketch showing the graphs of $y = x^3 - 13x + 12$ and $y = x^2 - 5$ indicating clearly on your sketch the coordinates (2 dp) of any stationary points, inflection (if any) and of any points where the functions intersect each other.

Determine the area between the graphs to 2 dp.

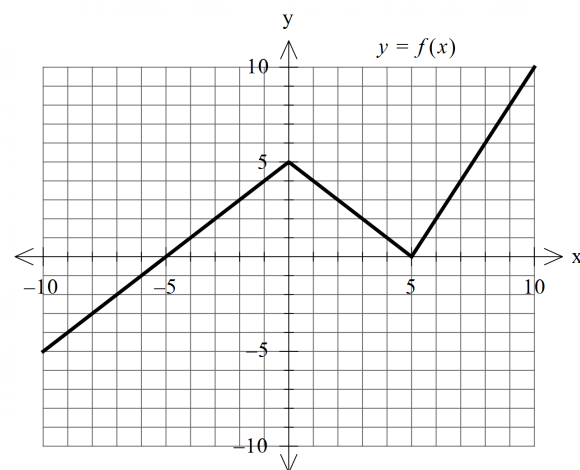


Q5 (4 & 3 = 7 marks) (3.1.2-3.1.3)

Let $f(x) = x^3 e^x$ a) Using **calculus** determine all stationary points and their nature. Justify.

b) Determine the x values of any inflection points.

Q6 (2, 2, 2 & 2 = 8 marks) (3.2.15-3.2.17)

Consider the function $y = f(x)$ which is graphed below.

Determine the following.

a) $\int_{-10}^{10} f(x) dx$.

b) $\int_5^{10} f'(x) dx$.

c) $\frac{d}{dx} \int_5^x f(t) dt$ when $x = 7$.

d) The area enclosed between $y = f(x)$ and the line $y = 2$.