Differentiation Ass 1 Obj

1. A function f is defined by $f(x) = 3x^3 + 2kx + 9$.

   Given that $f'(-1) = 13$, what is the value of k?

   A. $-\frac{7}{2}$

   B. 2

   C. 5

   D. 11 **2**

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
B	1.3	C	0.67	0.58	NC	C1	HSN 020

$f'(x) = 9x^2 + 2k$

k is just a constant

$f'(-1) = 9(-1)^2 + 2k = 13$

$9 + 2k = 13$

$2k = 4$

$k = 2$. Option $\boxed{B}$

2. Given $f(x) = 3x^3 + 7x + 1$, find the rate of change of f when $x = 2$.

   A. 28

   B. 31

   C. 39

   D. 43 **2**

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
D	1.3	C	0.53	0.56	NC	C1, C1	HSN 024

$f'(x) = 9x^2 + 7$.

$f'(2) = 9(2)^2 + 7 = 9 \times 4 + 7 = 36 + 7 = 43$. Option $\boxed{D}$

3. Differentiate $2\sqrt[3]{x}$ with respect to x.

   A. $6\sqrt{x}$

   B. $\frac{3}{2}\sqrt[3]{x^4}$

   C. $-\dfrac{4}{3\sqrt[3]{x^2}}$

   D. $\dfrac{2}{3\sqrt[3]{x^2}}$ **2**

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
D	1.3	C	0.83	0.38	NC	C2, C3	HSN 091

$$2\sqrt[3]{x} = 2x^{1/3}$$

$$\frac{d}{dx}\left(2x^{1/3}\right) = \frac{1}{3}\times 2x^{-2/3} = \frac{2}{3\sqrt[3]{x^2}}$$

Option $\boxed{D}$

4. Given that $f(x) = \sqrt[3]{x} + 2x^2$, what is the rate of change of f when $x = 8$?

   A. $32\frac{1}{12}$

   B. $32\frac{1}{6}$

   C. $32 + 3\sqrt{2}$

   D. 130 **2**

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
A	1.3	C	0.31	0.89	NC	C2, C6	HSN 115

$$f(x) = x^{\frac{1}{3}} + 2x^2$$

$$f'(x) = \frac{1}{3}x^{-2/3} + 4x = \frac{1}{3\sqrt[3]{x^2}} + 4x$$

$$f'(8) = \frac{1}{3\times 2^2} + 32$$

$$= 32 + \frac{1}{12}$$

$$= 32\frac{1}{12}$$

The derivative gives the rate of change.

Option $\boxed{A}$

5. What is the gradient of the tangent to the curve $y = 4x^3 + x^2 + 3$ at $x = 2$?

   A. $24\frac{2}{3}$

   B. 39

   C. 52

   D. 55 **2**

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
C	1.3	C	0.53	0.69	NC	C4	HSN 02

$\frac{dy}{dx} = 12x^2 + 2x.$

Remember: The derivative is the gradient of the tangent.

At $x = 2$, $m = 12 \times 2^2 + 2 \times 2 = 12 \times 4 + 4 = 52.$

Option $\boxed{C}$

6. A curve has $\frac{dy}{dx} = x^2 + 5x + 4$.

   Find the x-values of the points on the curve where the tangent has a gradient of 4.

   A. -4 and -1

   B. 1 and 4

   C. -5 and 0

   D. 0 and 5 **2**

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
C	1.3	C	0.46	0.61	CN	C4	HSN 010

$x^2 + 5x + 4 = 4$

$x^2 + 5x = 0$

$x(x + 5) = 0$

$x = 0$ or $x = -5.$

Remember: The derivative is the gradient of the tangent.

Option $\boxed{C}$

7. A function is defined by $f(x) = 2x^2 - 9x + 4$.

What is the largest range of x-values for which $f(x)$ is strictly increasing?

A. $x < \frac{9}{4}$

B. $x > \frac{9}{4}$

C. $\frac{1}{2} < x < 4$

D. $x < \frac{1}{2}, x > 4$ **2**

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
B	1.3	C	0.45	0.59	CN	C7	HSN 172

$f'(x) = 4x - 9$.

f is strictly increasing when $f'(x) > 0$

$4x - 9 > 0$

$x > \frac{9}{4}$. Option $\boxed{B}$

8. The curve with $\frac{dy}{dx} = x^2 - 4x + 4$, has a stationary point at $x = 2$.

   What is the nature of this stationary point?

   A. maximum turning point

   B. minimum turning point

   C. rising point of inflexion

   D. falling point of inflexion **2**

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
C	1.3	C	0.76	0.36	NC	C9	HSN 08

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

Method 1 $(x-2)^2 \geqslant 0$ and $(x-2)^2 = 0$ only when $x = 2$. Hence $\frac{dy}{dx} > 0$ at either side of the stationary point.

Method 2 Nature table:

x	2^-	2	2^+
$\frac{dy}{dx}$	$+$	0	$+$
Sketch	/	—	/

Option $\boxed{C}$

[END OF QUESTIONS]