**IB Calculus Answers – Part A**

**1.** (a) At B, the gradient is zero.
From B to C, the gradient is negative.
At C, the gradient is zero.
From C to D, the gradient is positive.
At D, the gradient is zero. (A3) 3

**Note:** Award [½ mark] for each correct statement and round up.

(b) Gradient = 
=  (M2)

**Note:** Award (M1) for f(a + 4)

 =  (A1) 3

[6]

**2.** (a) *f* (*x*) = 2 + 25*x*–2 (A2) (C2)

(b) 2 + 25*x*–2 = 6 (M1)
25 = 4*x*2 (M1)
*x*2 = 
*x* = 2.5 (A1)(A1) (C4)

[6]

**3.** (a)  = 0 at point C (A1) 1

(b)  changes from +ve to –ve and is decreasing (A2) 2

**Notes:** Award (A1) for “+ve to –ve” and, (A1) for “decreasing”.
Accept equivalent answers, e.g. “decreasing, becomes zero, and then begins to increase negatively”.

[3]

**4.** (a) Substitute *x* = 1 into *f*(*x*), *f*(1) = 3. (M1)(A1)
 or (G2) 2

(b) *f* (*x*) = 6*x*2 –10*x* + 7 (A1)(A1)(A1) 3

**Note:** If the –1 is left in and written separately then the constant is wrong so max possible is (A2).

(c) Substitute *x* = 2 into (b) *f* (2) = 11. (M1)(A1)
 or (G2) 2

**Note:** No ft here if original f(x) is just written as answer for (b).

(d) Increasing. (A1) 1

(e) (i) No. (A1)

(ii) Because the gradient at *x* = 2 is wrong (or wrong sign) or
**any** **other** **valid** **reason** (*eg f*(*x*) has an inflection not a
max/min), (but note that *f*(1) and *f*(0) both agree, and both
the formula and the graph have a single real root near to 0,
so none of these is a valid reason).
A sketch of the graph from the GDC with no detailed reason
can be awarded ***(G1)*** if it is reasonable. (R1) 2

[10]

**5.** (a)

  (A2) 2

**Note:** The curve need not be exactly like this one. The candidate’s sketch must have (a, f (a)) as a minimum with a < 0, and (b, f (b)) as a maximum with b > 0.
The turning points do not need to be on opposite sides of the x-axis.

(b) (i) False (A1)

(ii) True (A1)

(iii) False (A1)

(iv) True (A1)

(v) False (A1) 5

[7]

**6.** (a) 2*x*3 – 2*x* (A1) (C1)

(b) *f*  (*x*) = 6*x*2 – 2 (A1)(ft)(A1)(ft) (C2)

**Note:** Award(A1)for each term.

(c) gradient = *f* (–1)

 = 6(–1)2 – 2

 = 4 (M1)
 (A1)(ft) (C2)

 (d) tan = 4 (A1)(ft) (C1)

[6]

**IB Calculus Answers – Part B**

**1.** (a) *f*(1) =  + 1 – 4 (M1)
= 0 (A1)

 **OR** *f*(1) = 0 (G2) 2

(b) *f* (*x*) =  + 1 (A4) 4

**Note:** Award (A2) for  correctly differentiated
and (A1) for each other term correctly differentiated.

(c) *f* (1) =  + 1 for substituting *f* (*x*) (M1)
= –5 (A1)
**OR***f* (1) = –5 (G2) 2

(d) The gradient of the curve where *x* = 1. (A2) 2

**Note:** Award (A1) for gradient and (A1) for
x = 1 or at point (1, 0).

(e) *y* = 0, *x* = 1, *m* = –5 for using *y* = *mx* + *c* with their correct values
of *m*, *x* and *y*. (M1)
0 = –5 × l + *c*
*c* = 5 (A1)
*y* = –5*x* + 5 (A1)

 **OR**

 *y* = –5*x* + 5 (G3) 3

(f) *f* (*x*) = 0
1 –  = 0 (M1)(A1)
*x*3 = 6
*x* = (1.82) (A1)

 **OR**

 1.82 (G3) 3

[16]

**2.** (a) *f(x)* = 3*x*2 + 14*x* – 5 (A1)(A1)(A1) 3

(b) *f(1)* = 3 + 14 – 5 =12 (M1)(A1) 2

(c) 3*x*2 + 14*x* – 5 = 0 (M1)

(3*x* – 1)(*x* + 5) = 0

 (A1)(A1) (or (G3)) 3

(d)   (A1)(A1) (or (G2)) 2

(e) (A4) 4



**Note:** Award (A1) for axes labelled, (A1) for maximum, (A1) for minimum, (A1) for y-intercept.

[14]

**3.** (a) (i) *f* (*x*) = 6*x*2 – 6*x* – 12 (+0) = 6*x*2 – 6*x* – 12 (A2)

**Note**: Award (A2) for all four items correctly differentiated,
 (A1) for 3 correct derivatives.

(ii) *f* (3) = 6(3)2 – 6(3) – 12 = 24 (M1) (A1) 4

(b) 6*x*2 – 6*x* – 12 = –12 (M1)
 6*x*2 – 6*x* = 0
6*x* (*x* – 1) = 0
*x* = 0 or *x* = 1 (A1) (A1) 3

(c) (i) *f* (*x*) = 0  6*x*2 – 6*x* – 12 = 0 (M1)
 6 (*x*2 – *x* – 2) = 0
 6(*x* – 2) (*x* + 1) = 0 (M1)
 *x* = 2 or *x* = –1 (A1) (A1)

(ii) *x* = 2, *y* = –15 (A1)
Therefore, minimum is (2, –15) (A1) 6

(d) *x* < –1 and *x* > 2 (A1) (A1) 2

[15]